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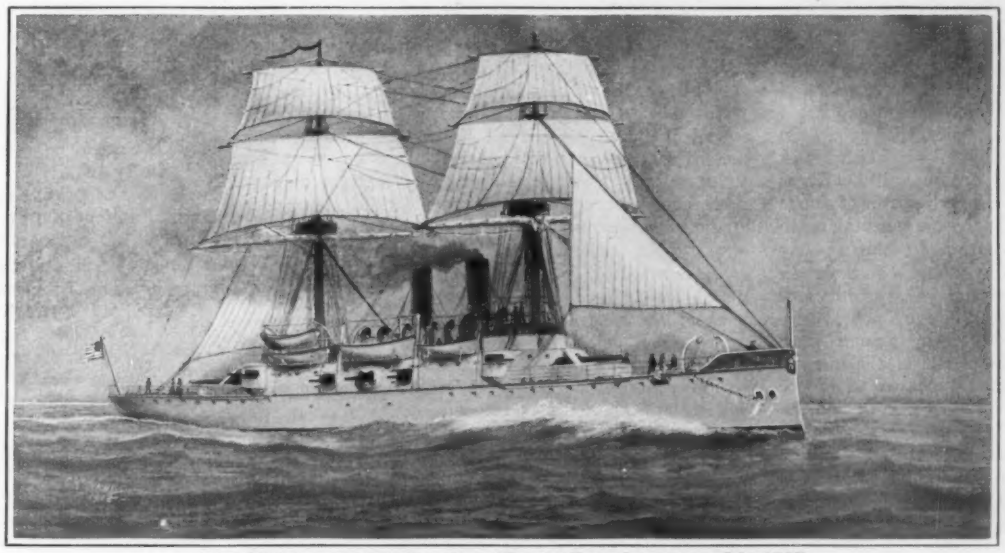
From Cruiser to Merchantship

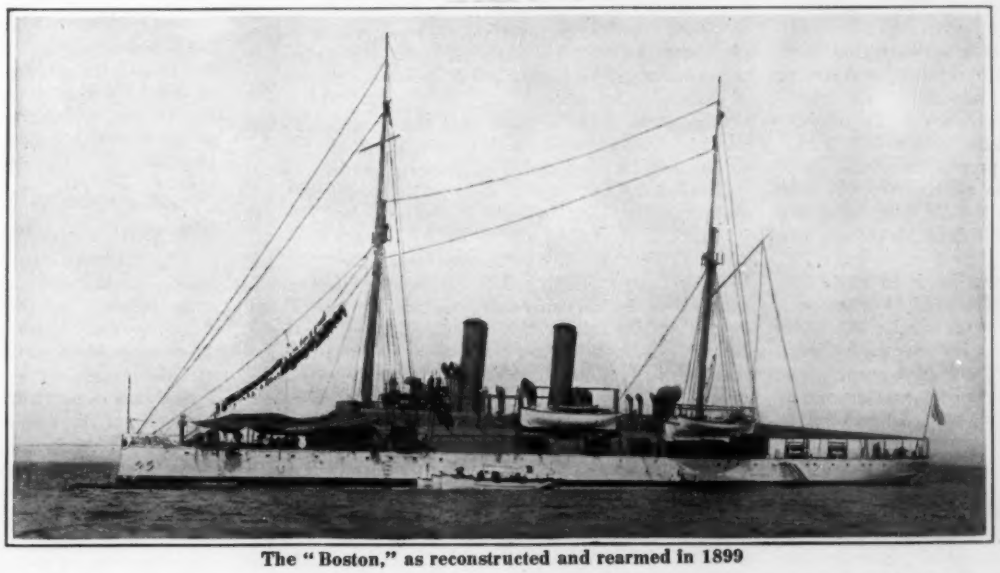
THE life history of one of the first ships of our new steel navy is told in the three views of the United States cruiser that accompany this article. Not often does it fall to the lot of a warship to end her career as a carrier of freight in a time of great national emergency.

The protected cruiser "Boston" and her sister ship "Atlanta" formed two units of a little fleet of vessels, which subsequently came to be known as the "White Squadron" and formed the beginning of our new steel navy during the early '80's. The "Boston" was a semi-protected cruiser of 3,000 tons displacement, whose length was 271 feet, beam 42 feet, and draft 20½ feet. She was driven by horizontal engines of 4,030 indicated horse-power at a speed of 15½ knots. Her protection consisted of a 1½-inch armored deck, which extended only above the midship portion of the vessel, and covered the engines, boilers and magazines. She was armed with two 8-inch and six 6-inch guns, and six 6-pounders four 1-pounders and two machine guns. Her complement was 282 men. She was built at Chester, launched in 1884 and completed in 1887, at a cost, exclusive of armament of $636,000. Her guns were of the old model, 30 to 35 calibers in length, and of the slow-firing type.

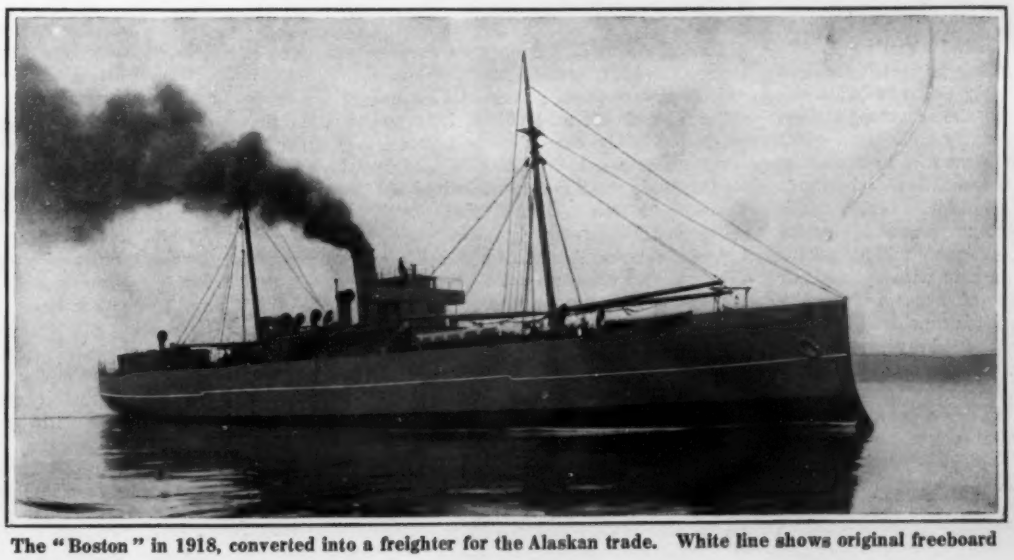
The "Boston," in common with many warships of that date, carried sails. She was rigged as a brig, and her appearance is shown in the accompanyingillustration. As the years passed by, the good ship became increasingly out of date and toward the close of the century, about in 1899, this ship and the sister ship, "Atlanta," were thoroughly reconstructed and brought up to date. All of the guns including the two 8-inch bow and stern pieces, were replaced by guns of the rapid-firing type, with the sights mounted upon a sleeve in which the gun recoiled, and the old, horizontal, compound engines were changed to triple expansion by the addition of high-pressure cylinders. The old Scotch boilers were replaced by two modern Scotch boilers and four Wilcox and Babcock water-proof boilers carrying high pressures. The bulk of the installation was thereby so far reduced as to permit the construction of an additional athwartship coal bunker, and the vessel's speed was measurably increased. The lessons of the Spanish-American war were turned to good account by ripping out all wooden bulkheads in the cabins, replacing them with steel, and substituting metal for wooden furniture.



The 3000-ton, protected cruiser "Boston," as she appeared in 1887



The "Boston," as reconstructed and rearmed in 1899



The "Boston" in 1918, converted into a freighter for the Alaskan trade. White line shows original freeboard

The sailing rig was removed, and the vessel appeared without any yards, and without her former heavy fighting tops.

The next transformation in this good ship, made some 20 years later, consisted in converting her to the uses of trade, so that she might enter the merchant marine as a cargo carrier. In doing this work, the side plating was carried up one deck higher until the freeboard from stem to stern reached to the level of the original boat deck. The forward funnel was removed, and a new bridge with pilothouse, etc., was built in front of the remaining funnel. The changes were made at a yard in Seattle, a city which is fast forging to the front as one of the leading shipbuilding centers of the country. We are given to understand that the cost of converting the ship was not large. It is a remarkable fact that the "Boston" as now changed has, for the present, a market value equal to if not larger than her original cost.

Inventors and the Gun Bombarding Paris

WITH the very first news that Paris was being bombarded at long range by German guns hurling shells over 75 miles, there were any number of opinions advanced concerning the means employed by the enemy. The most surprising feature, perhaps from an American point of view, has been the large number of Americans who have laid claim to the long-range gun. Some inventors take credit for extreme range shells fitted with propellers; others claim that the Germans are making use of torpedo-planes which they developed; still others claim that the Germans are employing electrical or compressed-air guns. Others declare that the Germans have amplified an old time American invention into present-day efficiency. In London and in Paris inventors are also claiming the credit. Among other ideas advanced, a French inventor believes the Germans are using his shell which emits warm gases to the end of lessening the head resistance of the projectile. All these claims, to be sure, are most interesting. Here and there may be found one which really has merit. Yet when the secret of the long-range gun is divulged, if ever it is, it is almost certain that the majority of the claimants will be disappointed.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Case of the Rural Trolley

WITHIN the past three months one of the largest street railways in New England has been obliged to discontinue service on more than one hundred miles of its system serving the smaller communities. The road gives as its reason a lack of sufficient revenue to meet the expense of the lines affected, and this action has been supported by the Public Service Commission of the state as a necessary step in solving the road's financial difficulties.

There can be no doubt that the majority of these lines have been a burden to the company. It is of course true that a transportation company owes something to the public, and that even as a matter of business policy it can well afford and may well be expected to maintain in a few cases service which does not pay, regardless of any hope that the territory may develop to a point where the service will pay. A street railway among other things owes its existence to the people of the locality in which it operates, and it must endeavor to supply them with service adequate to their needs. But on the other hand, the policy of swat the corporations is rapidly going out of style. We are nowadays reasonably willing to recognize that money invested in public utilities is quite as respectable and quite as deserving of a fair return as money invested in a grocery store or a moving picture theater.

It accordingly seems that it would be the part of common sense to seek a compromise between public and corporate necessities in a case such as that mentioned. Apparently the general assumption has been that there are only the two alternatives of operation at a loss or complete suspension—the one ruinous to the public only in less measure than to the operator, the other to the operator only in less measure than to the public. But it seems to us that in the present and hundreds of other cases where one of these alternatives has been adopted there is a third horn to the dilemma, which has been generally overlooked and which points the way to a successful adjustment.

The present street railway practice is to all intents and purposes confined to cars weighing eight or ten tons, operated by two men, and accommodating 35 or 40 passengers. A car of this weight is an expensive thing to haul back and forth with a handful of people in it; when traveling at speed it involves heavy wear and tear on the line; and when traffic is no more congested than on a line which has been, or is in danger of being, abandoned as unprofitable, surely a second man on the car is a useless expense.

We know no reason, other than that of the inertia of the human mind, why the practices which make the street railroad a success in the large city should be so blindly preserved under rural conditions to which they are not suited. This is all the more surprising in view of the way in which the automobile intrudes itself upon one's attention as the ideal type of passenger vehicle for light traffic. We do not mean to imply that runabouts and jitney busses should supplant the country trolley. But we are certain that the country trolleyman might advantageously adopt automobile practice to the extent of making his car more like an automobile than it is now.

The one-man car is, indeed, no absolute departure; it has been tried and found a valuable piece of equipment on certain lines where traffic conditions would not permit the use of the heavier two-man cars with their higher operating cost. An auto-truck of five tons capacity weighs no more than four tons; it is capable of handling the same number of passengers as the heavier street car, except for its lack of floor area. If then a piece of equipment is designed to run on rails, but with automobile rather than street railway practice as a guide, using the one-man feature, an economical power plant, and a very light body design, a vehicle could be resolved that would operate successfully under the adverse conditions that have caused the discontinuance of many lines and the institution of ridiculously inadequate service on many others.

It was in Massachusetts, by the way, that last summer, we walked fifteen miles along a trolley route of a hot Sunday afternoon, reaching our destination, as we had calculated, well in advance of the "next car." Had it been a week-day, we could have gone by the mail stage whose existence was the reason for such intermittent trolley service. With the wonderful roadway which its rails offer to a glorified automobile, it must be plain how the trolley company could put itself beyond all such competition if it only would. And of course, if the jitney-bus fire be not met with fire in this way, it is certain that more and more of our rural trolley lines will go by the board, instead of continuing to live on the traffic which supports the driver of the one-man car.

Proposed Reorganization of Health Department

IF there is one Department of the government of the City of New York and any one group of officials more than any other that has earned and holds strongly the confidence of the public, it is the Department of Health and the very efficient medical men who administer its various bureaus. These gentlemen are paid salaries of five thousand dollars a year, but their devotion to the Health Department is such that several of them have continued to serve the city for over twenty consecutive years, and this, in spite of frequent opportunities to exchange these Board of Health positions for others where the salaries would be several times greater.

Nevertheless, our present Mayor, who seems to have a special prejudice against all "experts," believes that these bureaus should be abolished, these five-thousand dollar salaries saved to the city, and that the department should return, so far as its organization is concerned, to the conditions of over half a century ago. Now, if Mayor Hylan had wished to bring out an expression of public confidence in the present organization of the Health Department, he could not have adopted a better course. The protest against his action has been widespread and it comes from pretty well every section of the community.

It may interest our readers to know that the organization of the work of the Department of Health under two bureaus dates from the year 1852. One of the bureaus established at that time dealt with records of birth, death and marriage; the other one with all the rest of the health activities being carried on. At the present time, this sounds like a large undertaking. As a matter of fact, owing to the paucity of medical knowledge regarding the nature of disease, its mode of spread, this bureau dealt mainly with such matters as drainage, inspection of cisterns and wells, overflowing cess-pools, defective plumbing, the control of offensive trades, street cleaning, the collection of garbage, rubbish and offal, the removal of dead animals, etc.

It must be borne in mind that this was long before anything was known about bacteria and their relation to diseases. The administrative efforts to control what was called the "contagious diseases" consisted in quarantine and isolation followed by more or less effective fumigation.

Following the brilliant discoveries of the '70's and '80's by Pasteur, Koch and others, a marked change in methods of health administration was brought about. In this city, we find an effort being made by Biggs, Prudden and others, to declare tuberculosis an infectious and communicable disease and to insist on the inauguration of administrative methods looking towards its control.

In 1892, the Board of Health established a bacteriological laboratory for the diagnosis of cholera—the first time in the world's history that a health department made use of bacteriological methods. This laboratory subsequently undertook the examination of cultures for diphtheria, of sputum for tuberculosis, and eventually developed into what is now known as one of the largest and best equipped research and diagnostic laboratories in the world.

The efforts made to control tuberculosis resulted in the establishment of tuberculosis clinics, attached to which was a corps of nurses who supervised the tuberculous in their homes. This activity was so unlike that conducted in the case of contagious diseases under the Sanitary Bureau that it was deemed best to establish for its administration a special division known as "The Division of Communicable Diseases." This Division subsequently took over also the administrative control of typhoid fever, cerebrospinal meningitis, and the venereal diseases. Its work was attended with such success that in 1912 it was changed into the Bureau of Infectious Diseases and given supervision over, not only the diseases just mentioned, but also over the so-called "contagious" diseases (diphtheria, scarlet fever, measles, chicken-pox, small-pox, whooping cough), which had, up to that time, been supervised by the Sanitary Bureau.

In 1876, the Department of Health undertook to combat the excessively high infant mortality prevalent in this city by the inauguration of what was called a "summer corps work." A corps of physicians was employed during the months of July and August to visit tenement homes and hunt out babies who were ill. In all such cases discovered, they gave advice to the mother and, if necessary, actual care and treatment. Although this had some effect in reducing infant mortality, the results obtained were not striking and it was not until the year 1908 that it was finally realized that the principle underlying "summer corps work" was unsound. In that year, the Department of Health established a Division of Child Hygiene, immediately following which the work against infant mortality was changed by having nurses visit tenement homes, hunting up all new-born babies and teaching the mothers how to keep the babies well. The results obtained by this change in method were striking and the infant mortality has continued to fall steadily since that time.

This Division also undertook the work of medical school inspection. Originally this work had consisted merely in assigning a medical inspector to visit a school each morning in order to examine and exclude from attendance, if necessary, any child ill with a contagious disease. Subsequently, under the Division of Child Hygiene, this activity was extended to include a careful physical examination of all the children attending school. Following such examinations, an effort is made to have the remediable physical defects discovered corrected. This Division also undertook the supervision of midwives, an activity which has been of great value in improving the service given to a large proportion of New York city mothers.

Replacing the abhorred "pest house" of bygone days, the department, about twenty years ago, began to develop a modern hospital service for the care of patients ill with contagious diseases. Due largely to the zeal and ability of the present Director of hospitals, this has grown to be one of the largest and best conducted hospital units in the world, having a present capacity of of over 3,100 patients.

Under the administration of Commissioner Lederle, a reorganization of the work of food inspection was undertaken and instead of having this administered as part of the work of the Sanitary Bureau it was given over to a special bureau known as the Bureau of Food and Drugs.

Toward the close of Commissioner Lederle's administration in 1913, the various divisions of the Department's activities were given the title and rank of Bureaus so that the Department at that time consisted of the following eight bureaus: General Administration, Records, Sanitary, Infectious Diseases, (now Preventable Diseases) Laboratories, Child Hygiene, Food and Drugs, Hospitals.

The youngest of the bureaus was created in 1914 under Commissioner Goldwater. This is the Bureau of Public Health Education, which has for its object the education of the public in health matters, to the end that intelligent public coöperation may be enjoyed by the Department of Health. Potentially, this is the most important bureau of the Department of Health, and one whose activities should be fostered and extended as much as possible.

Are Spiral Nebulae External Galaxies?

THIS question has been actively debated by astronomers during the past few years, and a timely summary of evidence pro and con is presented by Dr. Crommelin in a recent number of *Scientia*. It is interesting that astronomers are returning to the idea of Sir William Herschel that many nebulae and clusters are distant galaxies, or island universes, far outside our own. Herschel's estimates of their distances are quite of the same order of magnitude as those now accepted; he assumed, for example, that the Great Nebula in Andromeda was the nearest of them, and at a distance of about fifteen thousand light years. Spectroscopic proof, first adduced by Huggins, that many nebulae are gaseous, showed that their non-resolvability in the telescope is not an indication of immense distance and led to a reaction against the "external galaxy" idea; and the belief became general that all the nebulae belong to our own stellar system. The pendulum swung in the opposite direction after photographic methods had revealed the great number of spiral nebulae and their distribution with respect to the Milky Way—there are few near it, and they are most numerous near its poles. The spectroscope reveals enormous radial velocities in the spirals. Some are approaching or receding from us at a rate of more than one thousand kilometers per second. This implies motions across the line of sight of the same order of magnitude; yet these nebulae show hardly any measurable proper motion—another indication of immense distance. "Most of the evidence," says Dr. Crommelin, "seems to favor the extra-galactic position of the spirals; but if we once adopt this it follows that they are of dimensions quite comparable to those of our galaxy. This, combined with the resemblance of shape, justifies us in concluding, at least as a plausible assumption, that they are similar formations." Recent evidence also indicates that some of the globular star clusters are as distant as the spirals. Hertzsprung has suggested that the globulars are star systems in a settled state, while spirals are the result of the interpenetration and mutual capture of two globular clusters.

Naval and Military

Two 1,000 foot Docks for Norfolk.—The original plan of the Navy Department for the construction of new docks of the largest capacity called for two such docks at Philadelphia and one at Norfolk. This plan has been changed and one is to be built at Philadelphia and two at Norfolk. According to Rear-Admiral McLean, commanding the Fifth Naval District, one of the docks now under construction will be ready next fall. Their length will be such that any ship which can pass through the Panama Canal, where the locks have a limiting length of 1,000 feet, can enter either of the two docks which are to be built at Norfolk. This new work is of the most urgent character and it should be rushed to completion with all possible speed.

Electric Welding in Place of Riveting.—The proposal to use electric welding in place of rivets in securing the plating of a ship, is an attractive proposition if it can be done successfully, and we understand that tests which were recently made in the presence of the representatives of the Shipping Board have been so satisfactory that one of the engineers of the Emergency Fleet Corporation has been sent to Newark where the system is to be tried on a 9,500-ton ship which is about to be built by the Federal Ship Building Corporation of Newark, N. J. According to the dispatch, a low voltage is used and the current is applied to the metal through the ends of large forceps which press the sheets firmly together after the metal has become sufficiently heated to effect a weld.

The Plus and Minus of U-Boat Warfare.—All of us who believe that the psychological war is as important if not more so than the war of arms, will rejoice that the British Admiralty has decided to give, periodically, the full facts as to tonnage sunk and tonnage built among the Allied nations. Certainly the first statement of this kind, as made by Sir Eric Geddes, is reassuring. The total of Allied and neutral shipping losses, due to enemy action and marine risk in gross tons since the beginning of the war, is 11,827,572 tons. During that time, the Allies and neutrals built 6,606,275 tons of new shipping. Furthermore, there is a total of 2,589,000 tons of enemy vessels, either captured or taken over and brought into service. It follows that the net losses to the Allies and the neutrals up to the 1st of January, 1918, is 2,632,297 tons.

Aerial Mail Route to be Established. Postmaster General Burleson has called for the construction of five airplanes to be used in the establishment of an aerial route between Washington, Philadelphia and New York. The service contemplates one round trip per day, with the probability of a later expansion. Airplanes and parts are to be delivered as may be designated by the Post Office Department at the cities above named, not later than April 25th, 1918, and the War Department will release a sufficient number of motors to equip these airplanes. The airplanes must be capable of carrying 300 pounds of mail for 200 miles, without stop, at a maximum full load speed of 100 miles and a minimum full load speed of 45 miles. They must have a climbing speed of 6,000 feet in ten minutes. They are to be equipped with the celebrated Hispano-Suiza motor of 150 horse-power.

Why Torpedoed Ships Sink. —The Committee appointed by the Council of the Institution of Naval Architecture to inquire into the effects of explosions of mines and torpedoes upon the structure of merchant ships find that there are three principal causes of loss. First, the existence of a forward reserve bunker partitioned off from the cargo hold by a non-watertight bulkhead. A second cause of loss is the failure to close the water-tight door in the engine room bulkhead leading to the shaft tunnel. A third danger lies in the main drain pipes, leading from the bilge pumps to the different compartments, and passing through all watertight bulkheads, which are generally fractured in torpedoed compartments. There should be non-return valves on the ends of these pipes. The Committee recommends that bulkheads should be protected as far as possible from flying splinters, at least temporarily, by using timber or other suitable material as a splinter-screen.

A Bad Time Until August.—Admiral Lord Jellicoe, in an address at Hull last month on the submarine situation, said that the reason losses by submarines in the Irish Sea were so heavy was because there was shoal water on each side of the Sea, at the bottom of which "the submarines could lie for 48 hours at a time." When they "got a craft on to her the submarine would sit at the bottom until the trouble was over." He said that the difficulty of chasing the submarines into their own ports was that, for a radius of 150 miles around Heligoland Bight, the water was shoal and the submarines could sit at the bottom. At night a submarine could be seen at a distance of only 200 yards and the shoal area stretched for some 300 miles from Denmark to the Dutch Islands. "I am afraid," Lord Jellicoe said, "we are in for a bad time for a few months . . . but I have confidence that by about August we really shall be able to say the submarine menace is killed."

Science

Deep Sea Fishes at the Surface.—An admirably equipped station for biological research was opened at Messina, Sicily, in December, 1916. In a recently published account of the station, Prof. L. Joubin calls attention to the extraordinary facilities offered at this place for the study of the deep-sea fauna. The narrow and comparatively shallow Strait of Messina connects two of the deepest basins of the Mediterranean; one in the Tyrrhenian Sea and the other in the Ionian Sea. Four times a day a powerful current flows through this strait, alternating in direction. On meeting the obstruction offered by the abrupt rise of the ocean floor at the strait, the water is forced upward from the deeps and carries with it many forms of life which ordinarily never approach the surface, except when dredged up (usually dead and in a more or less unsatisfactory condition for study) in the course of oceanographic cruises. In the harbor of Messina a small boat and a hand net are all the equipment necessary for capturing live specimens of these curious and little known deep-sea creatures, many of which are provided with light-producing organs and can vary the color of their light at will. No wonder Messina is known as "the paradise of zoölogists."

British Research Committees.—The British Ministry of Reconstruction was established by Act of Parliament in August, 1917, to consider and advise upon the problems which may arise out of the present war and may have to be dealt with on its termination. This new ministry has appointed no less than 87 commissions and committees to deal with investigations in various lines, and many of these are entrusted with problems in scientific and industrial research, as follows: Fuel Research Board; Cold Storage Research Board; Standing Committees on Engineering, Metallurgy, Mining, and Glass and Optical Instruments; Joint Standing Committee on Illuminating Engineering; Mine-rescue Apparatus Research Committee; Abrasives and Polishing Powders Research Committee; Food-research Committee; Building-materials Research Committee; Electrical Research Committee; Committee for Research on Vitreous Compounds and Cements for Lenses and Prisms; Tin and Tungsten Research Board; Lubricants and Lubrication Inquiry Committee; Provisional Committee on Research and Education for the Cotton Industry; Provisional Committee on Research for the Wool and Worsted Industries; Provisional Committee for the Internal Combustion Engine Industry.

To Use the Heat of the Solfatara.—Much attention was attracted not long ago to the novel exploit of "harnessing a volcano," as carried out near Volterra, in Tuscany, where volcanic heat has been successfully utilized as a source of power. Now a similar plan is on foot in the vicinity of Naples, where the heat of the dormant volcano known as the Solfatara is to be tapped in the same way, and used for generating electric power and for other industrial purposes. The well known volcanologist, F. A. Perret, is aiding this undertaking with his advice, and incidentally hopes to get interesting scientific information in connection with the proposed borings. He reports that he has himself made some borings to a depth of a few yards, and that these tend to show the correctness of the hypothesis that the crater formerly contained a lake of boiling mud. The most striking thing shown by his investigations is the extension of this stratum of wet clay, at a temperature of 100 degrees C., over practically the entire present floor of the crater, at a depth of one meter. Even under the portions covered with vegetation the same high temperature prevails, and a new and powerful fumarole may be created at will in any place whatever. By placing a pipe so as to provide a conduit not destroyable by the collapse of its walls permanent fumaroles may be made.

A Research Information Committee, the function of which shall be to secure, classify and disseminate scientific, technical and industrial research information, especially relating to war problems, and the interchange of such information between the United States and its Allies, has just been organized by joint action of the War and Navy Departments, with the approval of the Council of National Defense. Headquarters have been established in Washington, and branches are to be maintained in Paris and London. In Washington the committee consists of Dr. S. W. Stratton, director of the U. S. Bureau of Standards, chairman; the chief of the military intelligence section of the Army; and the director of naval intelligence. The initial organization of the committee in London comprises the scientific attaché, Dr. H. A. Bumstead; the military attaché, or an officer deputed to act for him; and the naval attaché, or an officer deputed to act for him. Similarly, the Paris organization will consist of the scientific attaché, Dr. W. F. Durand, and the military and naval attachés of the American Embassy, or their deputies. It is superfluous to point out the immensely valuable work which such a clearing-house of information is capable of performing, not only toward the prosecution of the war but in the furtherance of undertakings of permanent value to science and industry.

Aeronautics

Mustard Gas Bombs.—It is reported that a German airplane recently flying over the American sector northwest of Toul, dropped rubber balls 18 inches in diameter, filled with liquid mustard gas, on our positions. This is the first time, as far as is known, that airplanes have been employed in such an operation. Luckily those dropped in our sector so far have not had any result worthy of being so called, but every man there was made furious by what is termed from one end of the sector to the other "dirty warfare." A sample of one of the rubber containers has been secured.

Aerial Mails for Denmark.—Quite a deal of useful work is being done by the Danish Aeronautical Society in preparing for aerial mail services which it is hoped to start when the war is over. Negotiations are pending with thirty-nine municipalities, according to *Flight*, in the matter of constructing landing stations, including hangars 1,300 feet square. Routes from Copenhagen to Odense, Frederica and Esbjerg, from Copenhagen to Kallundborg and Aarhus and from Copenhagen to Aalborg have been mapped out, and a route from the Danish capital to Gothenburg and Christiania is also planned.

The S. V. A. Fighting Scout.—Among the foremost fighting planes of our Italian Allies is the S. V. A. biplane the performance of which is in many ways quite remarkable. This biplane has a distinguishing feature interplane struts of steel tubing, arranged as lateral V-members so as to do away with the wire bracing cables. The struts are carefully streamlined, reducing still further the wind resistance. A six-cylinder S. P. A. motor is employed, developing 210 horse-power at 1,600 r. p. m. The principal characteristics of the machine are: Span, upper plane, 30 feet 2 inches, lower plane, 25 feet; chord, both planes, 5 feet 5 inches; gap, 5 feet 11 inches to 4 feet 11 inches; overall length, 26 feet 7 inches; overall height, 10 feet 6 inches; weight, empty, 1,411 pounds; weight, loaded, 1,984 pounds; engine, S. P. A., 210 horse-power; maximum speed, 125 miles per hour; minimum speed, 45 miles per hour; climb in 14 minutes, 13,123 feet.

The Standardization of Airplanes has been a much mooted subject of late in Great Britain, for it has a vital bearing on the war in the air. Lack of standardization appears to be detrimental to quantity production; but, on the other hand, and this is the strange feature of this kind of production, over standardization leads to a most deplorable state of affairs; for machines long rendered useless by the superior machines of the enemy, continue to reach the front in large numbers and cannot be safely used. An examination of the airplane problem discloses the fact that there are but four types which it is necessary to standardize. The first type is the fighting machine, which, according to one authority, should be standardized at least every month, and the drawings for that machine given to firms capable of an output of at least 25 machines a week. If they are given a month's start and are only called upon to commence five weeks after their drawings, and if there is a competent drawing staff, or rather a competent distribution staff, they will find it possible to turn out the machines at the rate of 25 a week after five or six weeks' notice if there is any organization. Of course, one condition in the realization of such an output is the standardization of certain fittings so as to expedite production.

German Trend Toward Large Planes.—Much has appeared in print lately about the German multiple-engined airplane, known in the German press as the *Riesenflugzeug*, or giant airplane. It is a considerable time since it was reported, but so far it appears that, as regards war purposes, such machines will remain for a considerable period nothing more than a bogey. So far as information is available, it appears that these machines are very big biplanes, equipped with four engines placed between the wings in much the same way as the engines of the Gotha type craft are mounted, except that they are tandem fashion, so that one set of engines on each side drives the pusher propeller behind, while the other set operates a tractor screw in front. There are several ways in which these engines could be placed on giant airplanes. A six-engined type at present must be purely experimental even in Germany. It seems improbable that any particular new combination type has been standardized. The chief reason given for the building of these enormous machines, according to the Manchester *Guardian*, is that they may carry bombs which, in the German way thinking, will destroy a whole section of a city at one stroke. Instead of carrying two or three bombs of 200 pounds apiece, they will probably carry two or three bombs of 1,000 pounds each, or possibly one enormous bomb of even greater weight. The Germans appear to imagine these huge machines invulnerable to attack by hostile aircraft, because they can carry so many machine guns and gunners and will afford such steady platforms that it will be folly to attack them. However, it is exceedingly difficult to hit the small, fast machines, which are apt to regard the big, slow-moving enemy as fair game.

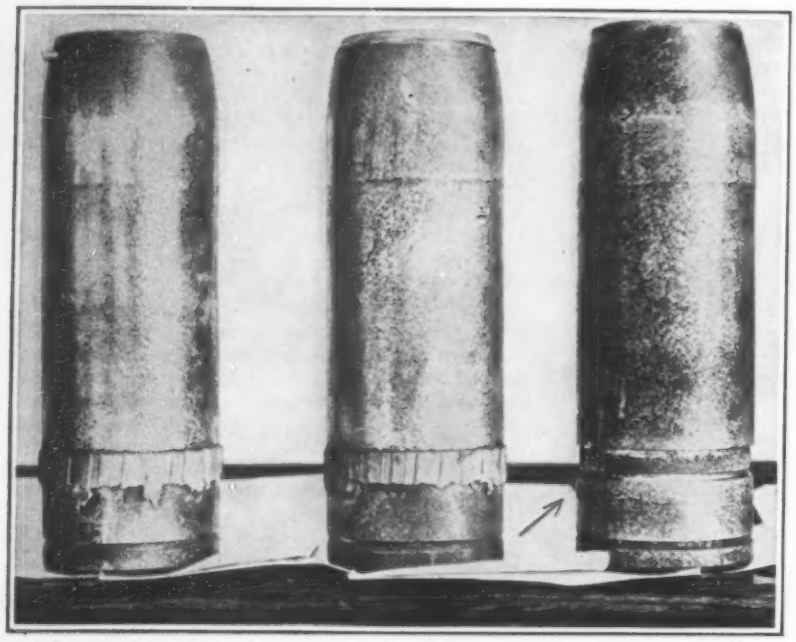


Fig. 4—If the band is of poor quality, the lands of the rifling cut it unevenly, as here shown, and cause ridges to project over the tail of the shell

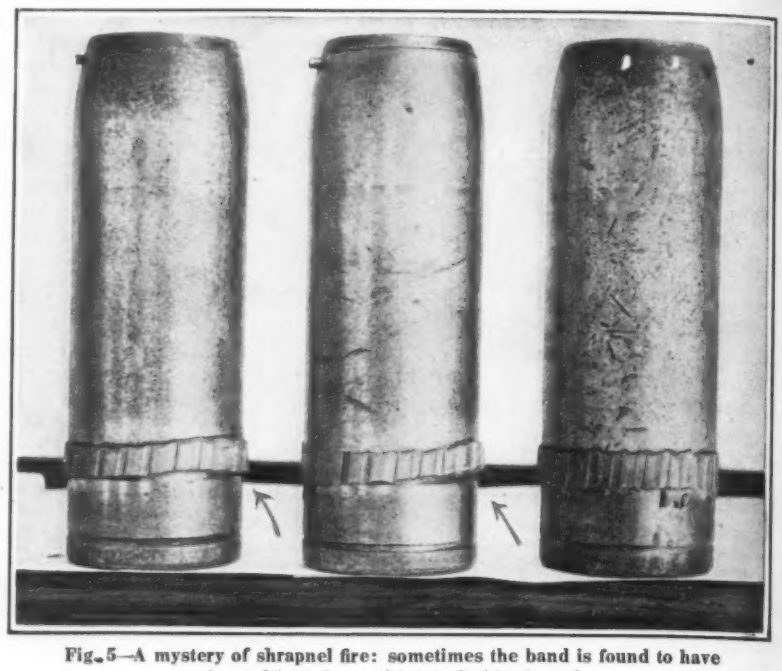


Fig. 5—A mystery of shrapnel fire: sometimes the band is found to have been driven forward instead of backward

Shrapnel Manufacture and Test

Some of the Difficulties Which Have to Be Met Before a Hail of Bullets is Possible

ONLY those who have had experience know the technical details and practical difficulties to be found in the manufacture of projectiles for use in modern ordnance. In the manufacture of shrapnel, the principal part is a drawn or forged steel body or case; this case is filled with a number of lead balls packed in melted resin and is furnished with a fuse and bursting composition. This last, in exploding, drives out the balls and scatters them over quite a space, each with a velocity sufficient to inflict a serious wound.

If the steel shrapnel body or case is made of too soft material, it will buckle or swell under the high pressures to which it is subjected in the gun; if this swelling is sufficiently great, the case after firing will bear the marks of the lands or projecting surfaces of the rifling in the bore of the gun, may seriously injure the rifling and may thus affect in time the accuracy of the gun. To measure the amount of this expansion or swell, an instrument has been devised as shown in Fig. 1, when a vernier scale is used which, it is claimed, will read to one ten-thousandth of an inch. While quite ingenious in design, it is not believed that it possesses many practical advantages over ordinary outside calipers that can give readings of hundredths or even thousandths of an inch.

In order that breech loading projectiles may be given the necessary rotary motion around their longer axes, when fired from a rifled gun, each is provided near its base with a band of soft copper that is firmly seated in a cut in the body of the projectile called the band seat. To prevent the band from turning on the projectile as the latter is forced through the rifling in the bore of the gun, the band seat is roughened by cutting into waved ribs as shown in Fig. 2 or by knurling as shown in Fig. 3. The copper band is firmly held in its seat by being hammered into place or by being forced in under hydraulic pressure. It is very necessary that the closest possible fit of the band in its place be obtained so that it will not be torn off when fired. As the projectile is forced through the bore of the gun, the soft copper of the band is dragged or pulled to the rear by the lands, the marks of each of the latter being uniformly and plainly shown when the projectile is recovered after firing.

If the material of the band is defective or of poor quality, it will be cut in an ununiform or ragged manner as shown in Fig. 4, having projecting ridges spread over the rear portion of the projectile. As the projectile in its flight rotates in the air, these spreads or ridges offer varying resistances to the action of the air and thus cause irregularities and inaccuracies in firings. Usually the drag of the lands will pull the copper of the band of the projectile to the rear as it passes through the bore; but Fig. 5 shows fired projectiles where a portion of the band has moved to the front. Such an anomaly is difficult of explanation; it is thought probable, however, that it is due to some small portion of the band not being absolutely tight and thus allowing the powder gases to get under the band at such places. As soon as the pressure of the lands on the band is released at the muzzle, the gases can then act by their blast to force parts of the band up and forward. The possibility of such an action of the gases is demonstrated by pictures (not reproduced here) of the firing of a 12-inch mortar. As the projectile is just leaving the muzzle the action of the copper band has prevented any escape of gases, but when the same projectile is shown a fraction of a second later, clear of the gun, the action of the gases, moving faster than the projectile, is plainly seen.

It has been also suggested that the bands in question may have had parts driven forward by some obstacle on striking; but it is difficult to see how that could have happened. At any rate, the photographs of the projectiles show no signs of any such injuries.

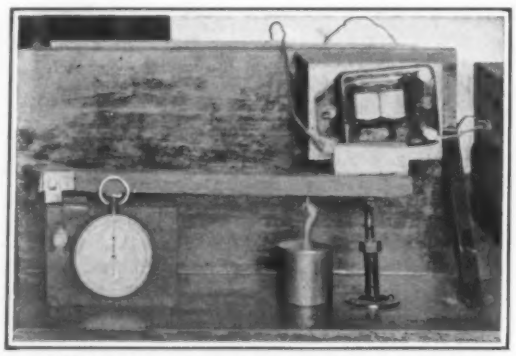
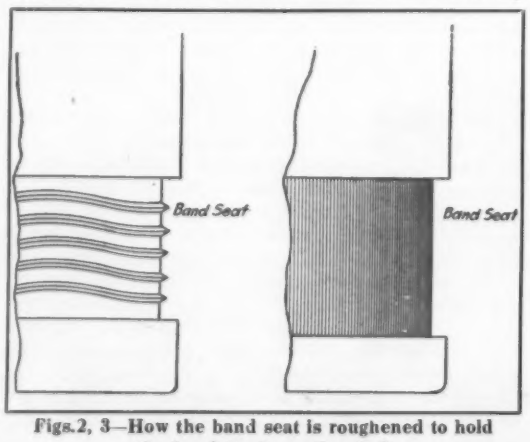


Fig. 1—The apparatus for measuring the swell of a shrapnel shell



Figs. 2, 3—How the band seat is roughened to hold the band firmly on the shell

The Agricultural Revolution in the South

By O. R. Geyer

THE necessity of war times has given impetus to one of the most radical changes ever attempted in the world history of the agricultural industry. The farmers of the South, interested alike in the governmental appeals for increased food production and the possibility of making their farms the future granary of the United States, have undertaken the tremendously vital task of rehabilitating the farming industry. Where King Cotton once reigned supreme, rotation of crops and diversified farming have gained a foothold and are now accomplishing wonders in speeding up the crop production of the southern states. Although the reform was first launched on its way before the beginning of the war, it has required the unusual conditions now existing throughout the world to hasten the end which is keenly sought for by the Department of Agriculture at Washington and the progressive farmers of the South.

The conversion of the South to the program of diversified farming is not a blow at cotton, but rather is intended to enhance the value of that crop and at the same time add new assets to the farm output of the South. For generations the South has placed all of its agricultural eggs, so to speak, in one basket—the cotton crop, despite the fact that cotton stands convicted in progressive agricultural circles of being a rank soil robber.

The result of this one-crop policy has become more and more apparent as adversity has settled down upon the average small farm, apparently for a permanent stay. The earnings of the average tenant—and he is greatly in the majority in the South as far as numbers are concerned—have decreased until they have reached a pitiful minimum ranging from $350 to $400 a year, barely enough to keep the wolf outside the door. Alabama and other great cotton growing states have, as a result, become importers of foodstuffs, although their soil resources would enable them to export many times the quantities of foodstuffs now imported. Alabama farmers have been paying from $40,000,000 to $60,000,000 annually for foodstuffs and supplies which could have been grown equally well or better within the borders of the state; and the consequent decrease in local purchasing ability has made the state a commercial back-water of the worst sort.

The deadly ravages of the cotton boll weevil and the continued decline in the output of the average small farm, so alarmed farsighted southern farmers that they began to lend a willing ear to the doctrine of crop diversification preached from Washington and practiced so extensively in the northern and central western farming states. The world war and the terrific slump which caught the cotton market unawares added fuel to the movement for agricultural reforms. The "Buy-a-Bale-of-Cotton" movement in 1914 was a desperate remedy to tide the cotton growers of the South over the greatest crisis since the Civil War. The panic cost the state of Alabama approximately $60,000,000, the bulk of this staggering loss falling upon the poor white tenant farmers who could ill afford such a loss.

The rich soil had been so impoverished by generations of cotton crops that in thousands of cases it was scarcely able to yield enough cotton and other minor crops to save the tenant from starvation. The farm wealth per capita of the southern states reached a ridiculously low figure compared to that of the North, ranging from $230 in Alabama to $325 in Georgia. Compared with these small values the Iowa farmer with his per capita wealth of $3,386 became the country's agricultural Croesus. This alarming condition so stirred up the progressive southerners that they have joined hands with the Government in promoting the gospel of better farming among their neighbors. Experiments conducted with the coöperation of agricultural experts demonstrated that it was possible for the average tenant farmer to increase his yearly earnings to $1,000, or about four times his whole present wealth.

Led by Mrs. G. H. Mathis, one of the most remarkable woman farmers in the world, Alabama bankers and business men and farmers inaugurated a campaign

(Concluded on page 392)

A Strange Botanical Garden

Where the Molds That Grow in Old Books Are Studied

A FRENCH scientist, Dr. Pierre See, has recently communicated to the Academy of Sciences in Paris the results of original botanical excursions which he has been making in the libraries. By means of microscopic examination of moldy volumes, together with experiments in propagation, he has shown that these blemishes are caused by fungi of low orders. Certain of these molds secrete a pigment whose color is characteristic of the species, and which diffuses through the paper.

More than thirty years ago a Hungarian botanist, Jules Schaarschmidt, attempted to study the plants met upon the edges and in the folds of old bank notes, among the dust and dirt. He scraped the surface of paper money in these places, and transferring the deposit thus secured into a drop of water placed under a microscope, he was able to establish the presence of an abundant cryptogamic vegetation. But he pursued his investigations no farther than this.

Dr. See has not been content with so superficial a glance. In observing closely, under high magnification, each spot of an old book or of a more recent volume which has been sojourning in a damp place, these are seen to be composed of two parts—a rather dark central nucleus, generally made up of the vegetative members technically known as the mycelium, and a lighter peripheral zone of more or less rounded contour, colored by the secretions of the fungus and ordinarily, through diffusion of the pigment, visible on both sides of the sheet. Likewise the molds are found in stages of vegetation varying widely according to the circumstances under which they have been living.

Here, for example, is a book printed in 1913 and left for several months near a wet wall. If we turn the leaves, we observe in certain places on page 28 a greenish yellow discoloration due to perfectly developed Chaetomium. The spots on page 29 came from contact with the preceding ones when the book was closed. Continuing our indoor botanical expedition we discover, upon certain pages, some rose-colored spots caused by Fusarium, while the tiny points scattered about the surface of the paper represent Alternaria reduced to a form of encysted preservation. Other species of book molds like Stachybotrys give spores which reveal themselves in the form of a black powder when the paper is torn. All these germs do not proceed from a late infection, but exist in the raw fibres of the paper-making material; for when we examine freshly manufactured paper, either by a direct light or by looking through it, we see here, too, spots of different forms, which are sometimes even sensible to the touch.

When found upon ancient volumes dating several centuries back the lower fungi are dead and desiccated; they may then be differentiated by simple examination only in case it is a matter of Chaetomium or of Acrostalagmus, both of which leave a permanent characteristic spot. But if one herborizes in more recent volumes one will there discover mycelium elements still living and capable of developing into considerable areas.

So M. See, a gardener of a new sort, has systematically cultivated mycelium collected from various sources. It is necessary to have his "seeds" as aseptic as possible, under pains of seeing his small "beds" overrun by all sorts of "weeds"—Penicillium glaucum, Mucor mucedo, Phycomyces, Rhyzopus reflexus, and other common molds. For his cultures he uses various media—carrots or potatoes, licorice, gelatine, paper or wood; and he keeps them in tubes, in boxes, and in other small "greenhouses" of glass. Frequently he employs licorice roots, with the corky bark peeled off to lay bare the yellow sapwood whose tissues contain glycyrrhizin, a sweet substance very favorable to moldy growth. Before "planting" he heats the culture in an autoclave to 120 degrees, maintaining this temperature for an hour, in order to kill the parasitic spores.

Examining the flowers in the novel botanical garden

Blastomyces lutens, a fairly common book mold, under cultivation

The small bottles, once cooled, are then ready for "seeding." Holding a bottle in the left hand, he uncorks it and tips it for an instant, while he places rapidly upon the licorice a small quantity of spores, using for this purpose a platinum thread inserted in a glass handle and previously passed through the Bunsen burner to destroy foreign germs. He at once recorks the bottle, which he then puts away in a hot closet or a warm bath.

The plant develops under the eye of the vigilant cultivator, the mycelium extends, and at the end of three to six weeks it can be identified. Sometimes the licorice rods are decorated with the pretty ochre felting of Acrostalagmus cinnabarinus; sometimes this strange horticulturist sees born various Alternaria of blackish pigment, or Fusarium which secrete a cerise coloring matter approaching the shade of dregs of wine; sometimes there appears the apple green Chaetomium, the brownish yellow Aspergillus repens, or the bright brown or maroon Spicaria elegans. But in spite of the diversity of paper-making materials and of his experimental conditions, M. See has succeeded in isolating only a score of species of inferior fungi, which constitute perhaps the entire flora of his world of paper.

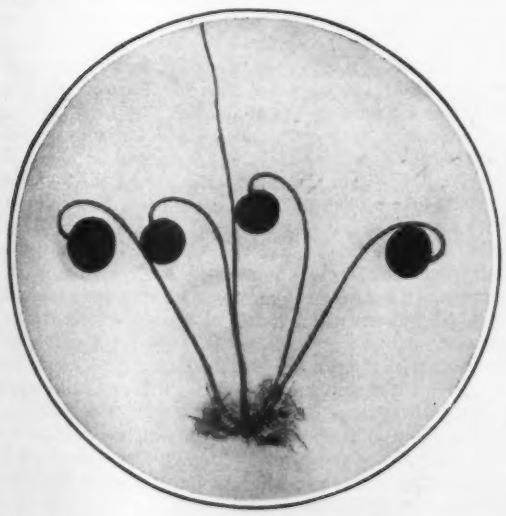
Hooverized Food for Horses

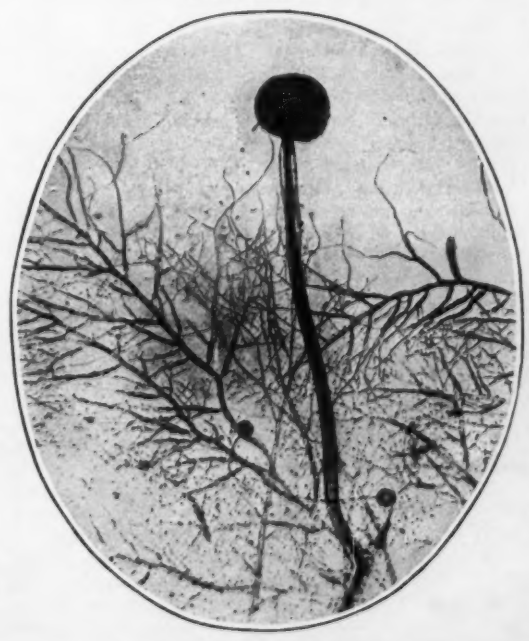
IN these days of voluntary or universal conservation of cereals, it is worth while to consider the possible saving of a percentage of oats and other grain utilized as fodder for horses. A French Lieutenant Colonel of Artillery has written a letter to *La Nature* (Paris), in which he gives the results of the successful employment of kitchen garbage to form a portion of the feed for horses, and this, without any loss of condition on the part of the animals. The scraps and leavings of raw vegetables are excellent for this purpose; certain horses, however, will not eat potato peelings unless they are first boiled. According to the officer in question from one half kilogram to one kilogram of such vegetable debris can be assimilated by a horse. Bran can be successfully replaced by sawdust from the birch or the poplar tree; from one half to one kilogram of such sawdust soaked in greasy dish water, still warm, is excellent to use for roughage.

Sawdust from the oak, however, is indigestible, while that from the pine causes inflammation of the intestines because of the turpentine it contains. Apple pulp from the cider press, which is generally thrown on the manure pile, is a food of very great value. Mixed with oats to the amount of one kilogram per day, it will take the place of one half kilogram of oats. The aforesaid officer states, that all these rations were regularly used at the front with admirable results; the only condition being that such food has not begun to ferment or decompose.

Poison Larkspur

ACCORDING to the Department of Agriculture, upwards of 5,500 head of cattle have been killed by poisonous plants within the past three years on ranges in the National Forests, and about 90 per cent of the mortality was due to larkspur. As this plant grows mostly in isolated patches it is found feasible to dig it out, and this method of eradication is recommended. The subject is fully discussed in Farmers' Bulletin 826, which describes the methods of grubbing and the tools used. The work is best done early in the season, when the larkspur plants show up most conspicuously.





Ordinary molds, which are weeds in the librarian's botanical garden

From left to right these are Rhyzopus reflexus, Mucor mucedo, and Penicillium glaucum, each magnified about one hundred diameters

Strategic Moves of the War, April 17, 1918

By Our Military Expert

THE first phase of the great battle in Picardy terminated practically on April 1st by the Germans finding themselves stopped in the region of the Somme by the English and French, who had met attacks such as had never been anticipated.

In their advance in this region from the Cambrai sector the Germans had been favored by exceptional weather, by full knowledge as to the time and positions to be attacked and by having over the Allies the advantage of unity of command, of one directing head. By throwing fully a million men into the struggle they forced the British and French back from their original positions in front of Cambrai, St. Quentin and La Fère until the new line in this section now extends from Arras in the form of a right angled triangle through Ayette, Albert, Montdidier, Lassigny and thence across the Oise and behind the Aillette River to Ainzy-le-Chateau. It is hinged upon Arras on the north and the line of the Aillette upon the south and east.

The object of the Germans in their first advance developed as the ten days' battle proceeded; it was to push forward down the valley of the Somme to Amiens and thence to the Channel ports; such a result would at once have separated the English and French armies, to be dealt with in turn. But the close of the fighting at the end of March found the Germans in a hazardous position. On the Somme itself, they were strongly held and could not advance. The British lines held fast from Arras through Albert and prevented the forward move down the valley of the Ancre River; Arras itself with the heights of Vimy and of Notre Dame de Lorette proved a barrier that could not be overcome.

To the south of the Somme along the valleys of the Avre and the Luce Rivers some progress was made, but with such prodigious losses of men that a halt had to be called.

The frontal attacks having failed, it became necessary to widen out the salient to permit freedom of movement for further operations; because lack of room prevented the bringing up, not only of reinforcements to replace losses, but of the artillery and necessary material and supplies.

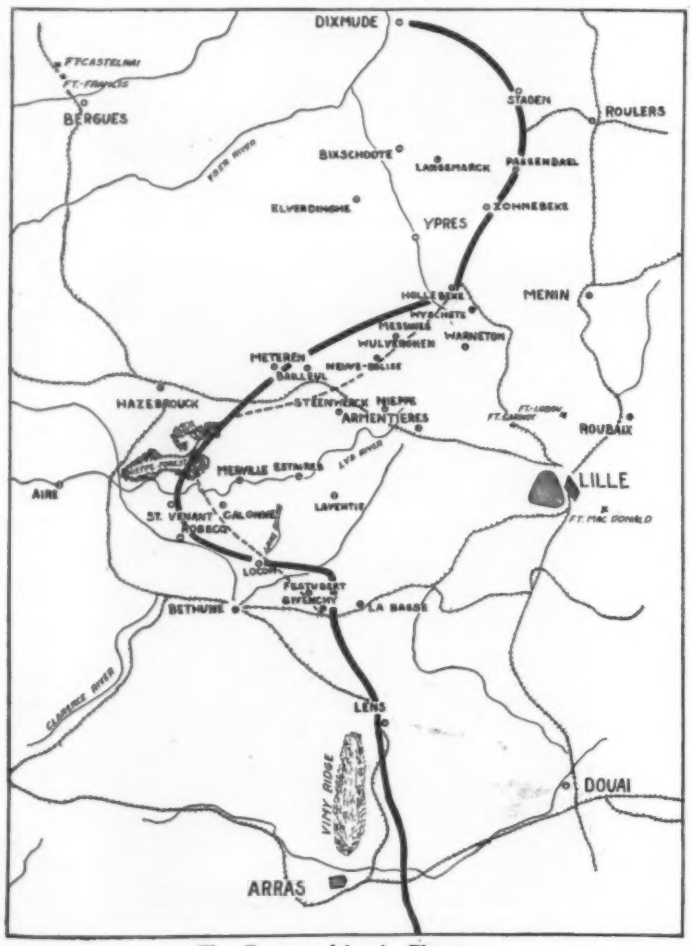
The first natural move therefore was to shake loose the pivots of the Allied forces at the extreme southeastern corner and at Arras. Having failed in two sanguinary battles to make direct progress upon Amiens, a huge effort was made by a drive on the French in the region of Montdidier with 150,000 men on a front of 18 miles; and although the French were finally forced back from the Oise and the forest of Coucy to prepared lines behind the Aillette, the attacks of several days duration were successfully resisted and the Germans were held.

An attack immediately afterward on a 10-mile front against the British east of Amiens met a similar fate.

The final results of the first phase of the greatest battle of the war left the Germans in possession of a great triangle the base of which, as stated above, was the original line from the Aillette and La Fère through St. Quentin to Arras; one side extended from Arras to Montdidier and the other from Montdidier below Noyon to La Fère and the Aillette River. But this position, especially on the south and southeast, is a most hazardous one, since it exposes a flank of 20 or 25 miles extending from Montdidier to the Aillette and running at almost right angles to the main front; this flank has been formed by the action of the French coming from the south and pushing the enemy westward; the latter has been thus prevented from getting the protection of the Oise and additional room for maneuvers.

The dangers of this exposed flank must have been one of the many causes for the strong offensive now in progress on the north. The main reason for the latter operations, has been that, in order to obtain room, the British hold on the heights of Vimy and further north on Messines Ridge must be broken if any further advance in the south was to be gained. To this end a tremendous attack was made during the past week on the British left from La Bassee to Armentieres and extending further north to Wytschaete, Hollebeke and the southern end of Messines Ridge. At first the Germans pushed back the British lines between the first two places and later over the 20-mile front from Givenchy and La Bassee to Hollebeke. Although the British grip upon the Messines Ridge is at the moment of writing shaken, if not actually broken, the pivots on which is anchored resistance to the progress of the German salient still hold—at Hollebeke in the north, at Givenchy on the south. A situation much like that on the Somme has therefore been created, with danger points for the Germans at the extremities of the salient. On this front, where strong and thoroughly organized opposition can be expected, such a drive as the enemy is making usually endures only for three or four days before a halt has to be made for reorganization and consolidation of positions. He has exceeded this period in making his greatest gain here of about nine miles; but this has been over a perfectly flat country where few positions for defense have offered. Even though the whole Messines Ridge be lost, the country further west is hilly and gives natural advantages for a strong defense.

For some time it was believed that the railroad center at Bethune, west of La Bassee and a most important supply point for the British lines in the vicinity, was the main object of the advance; but just now the Germans appear to have turned to the rail centers of Aire and Hazebrouck. Through the latter and the railroad via Poperinghe to Ypres the British lines of communications and of supplies for the Ypres section pass. In this sector it is essential, if the Germans wish to spread the salient, that they gain Vimy and Messines Ridges.



The German drive in Flanders

However, all battles here are not strictly to gain positions, they are struggles to determine which side can longest endure the strain of battle—which has the greatest capacity for endurance. When results of this titanic struggle can be determined, exhaustion will surely follow for one side or the other or both. There can be no error in saying that it is a fight to a finish for both sides. The recent orders of the British commander show that, for it is recognized that the English troops must protect and hold the Channel ports of Dunkirk, Calais and Boulogne and that this corner of France must be protected by an impenetrable barrier. There must also be territory enough in front of them to permit troops and supplies to move to the front and spread out. In the present case they have never faced greater odds nor shown greater courage and morale under most trying conditions.

As the battle progresses it becomes evident the Germans are striking at what they believe to be the weakest points, and the results obtained are in no way commensurate with the losses suffered. On the north they are only 40 miles from Calais and the main lines of communication run directly from the battle front to the Channel ports. If they can muster sufficient driving power, their assaults will no doubt be continued with the hope that, in some manner, a flanking operation can be carried out. This applies notably to the battle around Neuve Eglise where a successful drive would mean the outflanking of the Messines and Wytschaete Ridges; they would thus encircle the strong British positions to the east and northeast that have so successfully resisted frontal attacks. The varying successes obtained by each side here and the attacks and counter attacks show that the British intend to fight it out here especially since reinforcements will enable them to meet each German gain. So far the main offensive has been on the Somme; that in Flanders has been only secondary. But, since war plans must always be open to quick decision and change, the secondary may soon become the principle objective. Of one thing there can be no doubt; as stated above, the Germans have initiated on the western front a contest of endurance the extent of which cannot as yet be determined. It is no longer a test of positions or strategy, but of main human physical strength, endurance and force. This will be especially true if the army of maneuver, so often cited, can be assembled, and used by General Foch at the proper time. Just now at least such an army seems possible and it may be that a more stupendous battle than that of the Marne is to follow at a early date.

In the vicinity of Verdun and Toul, where Americans are on the battle lines, there has been fighting of considerable intensity. Similar operations have been developed against lines held by Americans in the Woevre district and in the Vosges mountains. All attacks have been repulsed with loss in killed and prisoners for the Germans.

The extent of the great operations in France has taken attention away from possible happenings on the Italian front where events are not likely to remain unimportant for any length of time. It is not well understood why the Germans attacked in France when such operations could not coördinate with similar movements by Austria in the way of an attack on Italy. When operations ended last autumn, the Italian front had been reduced to a distance of 180 miles extending from the mouth of the Piave River to the Alps and thence west to the Swiss border. The full value of the enveloping situation of the Austrians could not be developed until the spring season allowed free movement of troops in the Tyrol, and under usual conditions, that does not take place until May at the earliest.

The advantage of this coöperation was deliberately thrown away by Germany when the present drive in France was begun on March 21st; for some unknown reasons, it was deemed wise by the German General Staff not to wait six weeks in the hope that combined operations on the Italian and western fronts might then render impossible the assembling by the Entente of reserve armies of maneuver in sufficient numbers to be effective. Perhaps the German commanders believed that the great numbers of men and guns brought up to the western front placed them in such command of the situation that no help was needed elsewhere. While it has been reported that Austrian and Bulgarian troops are on the western front, practically all of the Austrian army is facing the Italians. Forty divisions were placed here last fall and 11 more have been brought from the Russian front. Some sixteen divisions are still unaccounted for; but as it has been the tendency to withdraw Austrian troops as far as possible from the control of German commanders, it is probable that all are assembled for a purely Austrian campaign in Italy. In the Tyrol proper, there are supposed to be at least thirty-seven to forty divisions or about four hundred and fifty thousand men, who must be concentrated in the very restricted area of the Trentino. On the Piave are assembled at least twenty-five divisions or 300,000 troops of all arms.

But exactly how the campaign will begin is not yet clear, as much will depend on the success or failure of the German drive in the west. The line of the Piave is strongly held by the Italians; to attack with a river in one's front is not an easy matter. To come into Italy from the Trentino means movements by divergent routes and roads; to move under such conditions in supporting distances is by no means an easy undertaking. This will be seen where it has been suggested that one advance might be made down the Adige to Verona and the other west of Lake Garda to Brescia. Such moves in the face of a strong enemy violate all laws of strategy unless each advance is with overwhelming forces. The Italians have not been idle during the winter months and, with their allies, are no doubt keeping strict watch and are making every preparation to resist successfully any hostile operations on their own flanks.

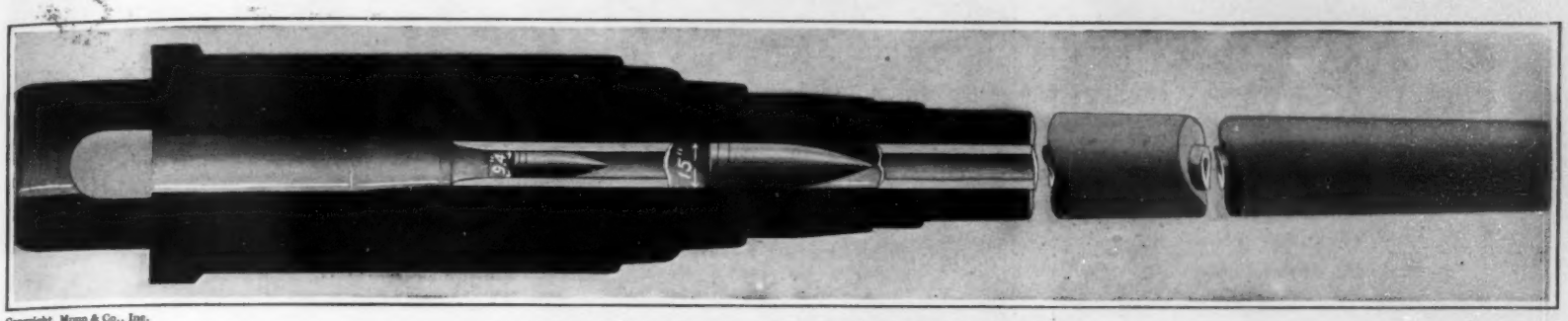
The Turkish-German forces in Palestine opened a

(Concluded on page 392)

Velocity and Range of Guns—II

How Super-Range Can Be Secured with Existing High-Powered Rifles

By J. Bernard Walker



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A 15-inch, 50-caliber, Krupp, naval gun, sub-calibered to 9-4 inches

It is understood that the Germans are utilizing some 15-inch guns, built for their latest battleships, for bombarding Paris. This is done by inserting a liner (shown above in white) and boring it to take a 9.4-inch shell. Krupp claims for the 15-inch shell a velocity of 3100 foot-seconds. With a full charge of suitable powder, the 9.4-inch shell would have a velocity of 6200 foot-seconds. In the drawing, the liner is broken away and a 15-inch shell inserted for comparison.

IN the previous article on "Velocity and Range of Guns," three different methods of securing extreme range were considered—namely, a gun using a compound shell, a gun using a sub-caliber shell, and a gun of standard type, but with a large powder chamber and extremely long barrel.

As regards the compound shell it was shown that, because of gyroscopic action, the inaccuracy would be so great as to render the gun useless. In addition to that fundamental difficulty, the structure of each super-caliber shell would have to be made of such thickness and strength to resist the bursting stresses of the firing charge that each successive shell would be of very greatly reduced diameter, and the final, explosive shell that was intended to complete the trajectory would be so small as to be useless even for bombarding purposes. If the final shell were to be of any serviceable size, such as 8 to 10 inches, the diameter of the compound shell, as assembled for firing, would be so great as to require the construction of a gun far exceeding in weight and length the heaviest artillery of the present day. In addition to the great thickness necessary in the wall of each shell, to enable it to act as a gun for the shell within it, there would be the difficulty of the large powder spaces required to give the desired velocities. These powder chambers, if we can call them that, would be so large that the compound shell would be of an absolutely prohibitive total length. In this connection, the space required for the powder charge of one of the most powerful guns in existence is very significant. The cartridge for this particular gun is nearly 18 inches in diameter, weighs about one-third of a ton, and is no less than 10 feet in length. So we are safe in stating that no practical gun maker will ever attempt to construct a long-range gun upon this principle.

Another problem that would have to be solved is that of providing a reliable time fuse tor firing the successive shells at the desired point in the trajectory. The elevations attained by the shells of anti-aircraft guns are moderate compared with those which the shells of a 75-mile range gun must attain. Yet great difficulty has been experienced in providing fuses that will function reliably at the extreme ranges of anti-aircraft weapons; although since the outbreak ot the war, the efforts of many inventors have been directed to the problem. The rate of burning of a time fuse depends greatly upon the density of the air. The irregular density of the atmosphere at the summit of the trajectory of high-angle fire howitzers and anti-aircraft weapons is a condition that has greatly complicated the calculations of the artillerist.

Secondly, as regards the use of a sub-caliber shell in a large-caliber gun, while it is true that the velocities vary inversely as the square root of the weight of the shells, and, as we showed last week in the case of a 16-inch howitzer, it would be possible to secure high velocity with existing guns, it has not been possible to provide a cradle that will stand up under the enormous pressures and the severe torsional stresses to which it is subjected. Furthermore, great difficulty has been experienced in releasing the shell from its cradle, and the flight of such shells has proved to be extremely erratic.

The third method suggested, namely, that the Germans had built an entirely new gun with large powder chamber and possibly 100 calibers of length, is the most reasonable proposition of the three; but since the article referred to was written, we have learned on good authority that the Germans have not built a special gun, but have made use of some of the new 15-inch, 50-caliber guns which the Krupp works have built for one of the latest German battleships. It is stated that two or three of these guns have been sub-calibered by inserting a tube for the full length of the bore, so as to make it possible to use a smaller shell, having behind it a very large charge of powder, and driven through an exceptionally long path down the bore. As to the size of the sub-caliber shell, reports from Paris are contradictory—some stating that an 8.8-inch shell is being used and others a 9.5. The Ordnance tables of the Krupp works include an 8.2-inch gun and a 9.4-inch gun. It is probably that the 9.4-inch shell is employed.

It would be perfectly feasible to heat the gun and insert a liner having an external diameter slightly larger than the bore of the gun (15 inches), and secure it firmly in position by the well known method of shrinkage. The tube could then be bored to 9.4 inches and rifled. In this case the enormous charge for a 15-inch gun would be available for driving a 9.4-inch projectile through a gun that was 80 calibers long. Of course, it would be necessary to design a quicker-burning powder, in order to make sure that the whole charge was burned before the shell left the muzzle. The 15-inch shell weighs 1,680 pounds and according to the Krupp tables it has a muzzle velocity of 3,100 feet per second (there is much skepticism as to this high velocity among ordnance men in this country, but we will assume that the Krupps are doing it). The 9.4-inch weighs 420 pounds. The square root of 1,680 is 41 and the square root of 420 is 20.5, and accepting 3,100 feet per second as the velocity of the heavier shell, we get a velocity for the 9.4 inch shell of 6,200 feet per second.

If it be true that some of the guns built for one of the latest battleships of the German High Seas Fleet have been diverted to the German front in Picardy, we are justified in believing that the German Admiralty is not contemplating, at least for the present, any sortie into the North Sea for the purpose of breaking the blockade.

If it were possible to construct a cradle that was sufficiently strong to stand up to its work, and that would disengage itself from the shell without affecting the flight of the latter, it would be possible to fire a larger and more destructive shell than the 9.4 inch shell now being thrown into Paris. Take, for instance, our new Army 16-inch gun, which is designed to fire a 2,400-pound projectile with a velocity of 2,700 feet per second. If a 12-inch projectile weighing, with its cradle 1,100 pounds, were fired from this gun, it would be found by the formula referred to above, that the shell would have a velocity at the muzzle of about 4,000 feet per second.

The possibilities in the direction of super-range, even greater than that obtained by the German gun, were made the subject of study by the Bureau of Ordnance of the Navy, and a design was drawn up for a gun which would give ranges far superior to that attained by the gun now firing upon Paris. The study of the problem, however, was merely an academic one; for our Ordnance officers realize that such a gun has no tactical value, and they know that the United States will never so far depart from its standards of civilized warfare, as to bombard indiscriminately the inhabitants of a great city.

Method of Testing Lubricating Oils

ALTHOUGH it may not be possible to give an exact definition of the lubricating power of an oil nor to attempt to employ a method for measuring this important property, it is found that it is directly connected with viscosity. It is well known that the viscosity of liquids can be observed by the Poiseuille method, by measuring the rate of flow through a capillary tube, and making use of a suitable formula which takes account of the quantity of liquid delivered per unit of time, the radius of the section, length of the tube, and pressure on the oil, whence is obtained a coefficient representing the viscosity. This latter decreases rapidly as the temperature rises. In practice, comparison is made of the viscosity of the product under observation with standard types of oils by passing the oil through a tube at the same pressure and measuring the flow. It is of interest to make such tests at different temperatures, for in the case of an oil whose viscosity decreases too quickly when the temperature rises, there is danger that it will cease to lubricate when heating occurs.

At a recent meeting of the French Physical Society, M. René Dubrisay proposed a simple device for making tests upon lubricating oils, and it gives sufficiently exact results. He makes use of a pipette containing an upper and a lower bulb of about two Cc. each, joined by a straight portion. A short piece of tube projects above the upper bulb, upon which is fitted a piece of rubber tube with a pinch cock. Below the lower bulb is also a short length of tube for outflow of liquid. Near the rubber tube is an upper mark, A, and between the two bulbs the marks B and C. The pipette is plunged in oil and taken up full, the upper surface of the oil being made to coincide with the top mark A; the filled pipette is then dipped into a vessel of water and left until the temperature reaches an equilibrium. Then the pipette is held by means of a support so as to bring the lower mark C at the level of the surface of the water, and the cock is opened so as to let the oil flow out. The time in seconds is counted which is taken for the oil to descend from A to B. As the variations in density between different oils are slight, the pressures of flow are practically the same in all cases. Again, the temperature can be closely measured, and it is an easy matter to operate with a series of temperatures throughout a wide range.

The method has the following advantages. The outflow from the end is always visible. A uniform temperature is obtained in the whole mass at the start, and this does not vary appreciably during the experiment. However, it may be asked, since the outflow takes place in water, whether the results are comparable with those usually obtained, and whether the present measurements of viscosity have a practical value. But the author made a series of tests upon a number of common lubricating oils, first with the classical Barbey apparatus and then with the present simple method. The curves obtained in the two cases have practically the same appearance, and in both methods the oils are classified in the same order. From these tests, the value of the author's method appears to be established. One practical point to be noted is that the new device can be used to find out at what temperature the oil ceases to flow, under a uniform pressure, and this test will be of value in the case of oils which are used in cold weather for lubrication of mechanical parts working in the open air.

War Service for Civilians

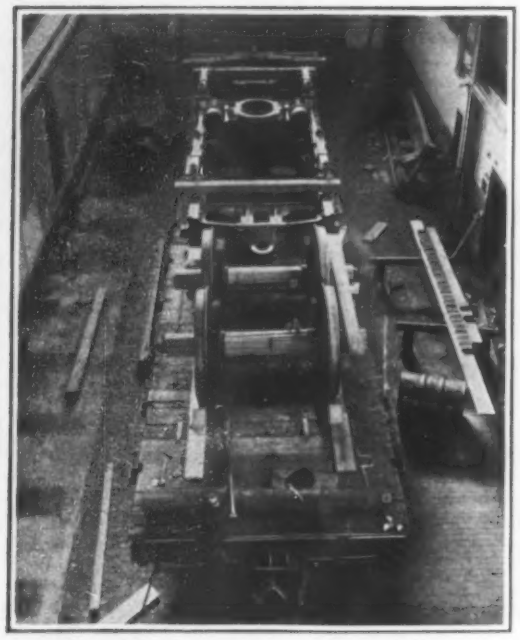
THE United States Government is in urgent need of thousands of typewriter operators and stenographers and typewriters. All who pass examinations for the departments and offices at Washington, D. C., are assured of certification for appointment. It is the manifest duty of citizens with this special knowledge to use it at this time where it will be of most value to the Government. Women especially are urged to undertake this office work. Those who have not the required training are encouraged to undergo instruction at once.

Examinations for the Departmental Service, for both men and women, are held every Tuesday, in 450 of the principal cities of the United States, and applications may be filed with the Commission at Washington, D. C., at any time.

The entrance salary ranges from $1,000 to $1,200 a year. Advancement of capable employees to higher salaries is reasonably rapid.

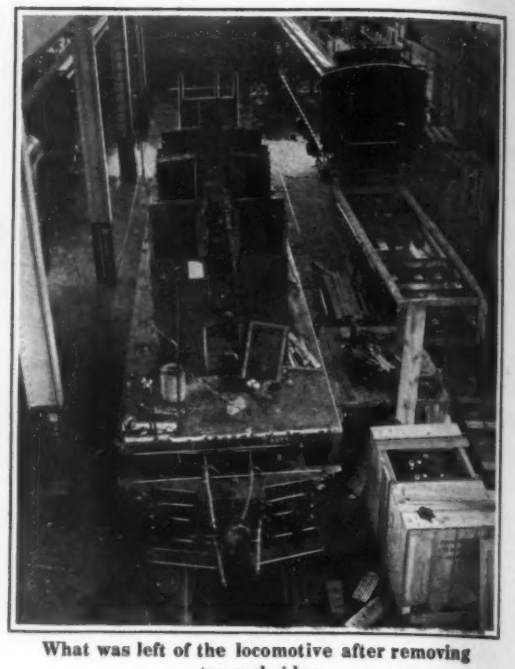
Applicants must have reached their eighteenth birthday on the date of examination.

For full information in regard to the scope and character of the examination and for application blanks address the U. S. Civil Service Commission, Washington, D. C., or the Secretary of the U. S. Civil Service Board of Examiners at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle, San Francisco, Honolulu, or San Juan, Porto Rico.



One of the driving trucks packed on two flat cars

One of the four-wheel truck frames being lowered into the steamer hold



What was left of the locomotive after removing top and sides

Loading A Huge Locomotive in Sections

How an Electric Traction Giant Is Dismantled for Shipment to South America

THE problem of exporting a large modern locomotive has been a severe tax on the ingenuity of engineers and shippers. Until recently the shipping of the largest type of engine has not been possible owing to lack of unloading facilities, especially the crane equipment, at the point of destination. The largest locomotives that were shipped to Panama were only 41 tons each, being loaded all ready for use on the freight vessel. Even this was executed with great difficulty and when a large electric engine was needed at a Chilian iron mine the facilities for unloading were so inadequate that there was no question of sending it already assembled. It must be knocked down and so arranged that when it reached its destination each part could be put together exactly as it was before it left the plant.

The unloading crane at the seaport of Cruz Grande handles only 35 tons and the steamship very much less than that, while the locomotive weighed 120 tons. Therefore it had to be dissembled.

Some few changes had to be made in the construction to permit the knocking down and setting up again at the mine. For instance the roof and sides which are usually riveted were put together with bolts and nuts.

When the engine is completed a thorough test is made, and if it is to be shipped the knocking down begins by first removing the trolley apparatus and numerous small equipment parts. These are boxed carefully, numbered and indexed so that any skilled mechanic would have no trouble in putting the enormous machine together.

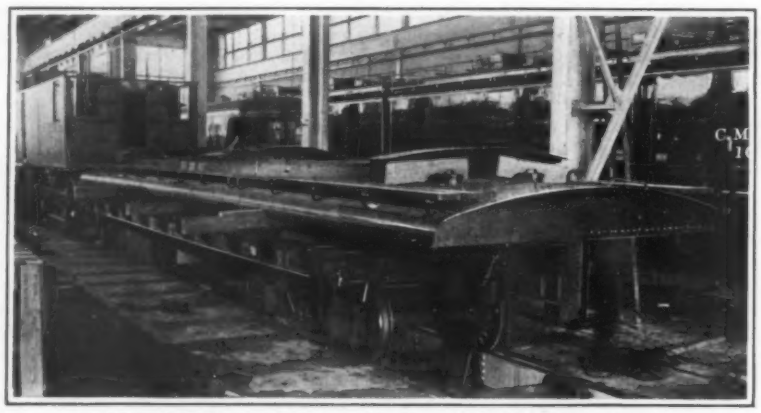
The entire roof comes off next. This weighs about five tons and after the bolts have all been removed a crane lifts it bodily and lays it aside until the platform is stripped, after which these two parts are packed together in order to give the roof a firm backing. These two parts weigh about twenty-three tons when boxed and ready for shipment. This is the heaviest piece handled and also the largest, measuring 46 feet 3 inches in length, 10 feet 6 inches in width, and 5 feet 7 inches in height.

All the electric connections and appliances, the motors, brake rigging, etc., are boxed with a view to easy handling at the end of the trip.

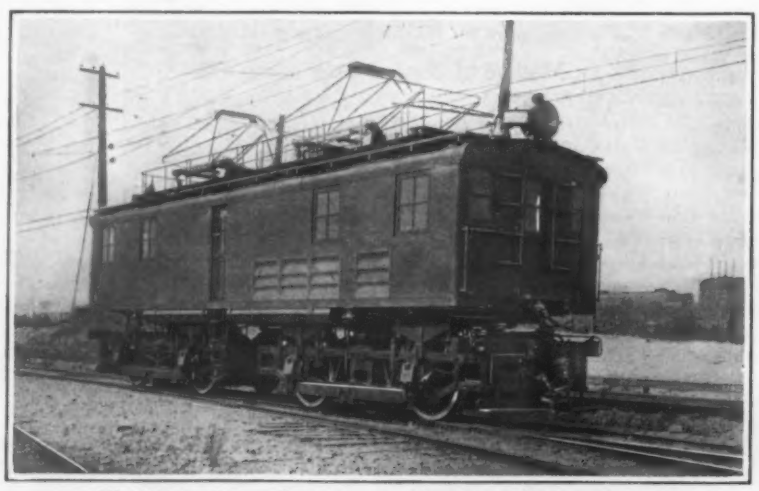
These enormous engines are built at the great plant in Schenectady, N. Y., where they are dissembled and shipped on eight cars, three box cars and five flats, to the steamship pier at Brooklyn. The small parts that are carefully boxed are loaded into the box cars while the heavy pieces and the unboxed ones, the truck frame for instance, are loaded on the flat cars.

Some important features have been developed in these locomotives to fit them for the special work in which they are used. From the seaport town of Cruz Grande to Tofo is only four miles, but the elevation is over 2,200 feet and in order to have an easy grade all the way the road winds around taking a distance of 15 miles to reach the iron mine at the summit. The air brake equipment on this engine has been developed to an unusual extent to allow it to descend with a greater load than can be held back by the regenerative braking equipment alone. The trains descend at about twelve miles per hour at which speed with a trailing load of 1,500 tons the locomotive will return almost 1,000 kilowatts to the line. By arranging a schedule so that one car ascends and the other descends the empty cars going up will take power from the loaded train coming down. The regenerative braking control permits the locomotive to descend the grades with ordinary loads without the use of the air brakes, thus returning power to the system and at the same time saving wear on brake shoes, wheels and rails.

Now that a way for transporting these locomotives has been devised and it is realized that the dissembling of these huge engines is an efficient method of shipping, some of the out-of-the-way places where big mining developments are carried on can modernize their railway service to the benefit of the whole world; for the quick and easy handling of any utility means a saving and therefore a cheaper price in the market.



Cab-roof resting on flat car while the cab is being demolished



The 120-ton locomotive that was shipped to Chile in sections

The Current Supplement

THE study of life is the most absorbing pursuit in the entire range of science, and the problems it presents are infinite. Whether the ultimate secret of life is an *ignis fatuus* remains for the future to demonstrate; but in the meantime scientific investigations continue, as the results attained are often of permanent value. A recent investigation relates to disturbances of equilibrium and is embodied in a paper on *Biological Effects of Centrifugal Action*, by a prominent French scientist, which will be found in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2208, for April 27th. We are so familiar with safes, banks and safe deposit vaults that we seldom give thought as to how people of the olden time protected their valuables. An article on *The Old Time Treasure Chest* tells us how it was done, and gives a description of the construction of these chests, a number of which have found their way to this country. The article is illustrated by a number of cuts. A problem of great public importance in the economic development of our country is the proper utilization of the water power with which we are so abundantly supplied, much of which is under the control of the Government. A valuable statement of the case is contained in *Hydro-Electric Development*, which is a presentment of the facts before the United States Chamber of Commerce by a representative of several of our most prominent engineering societies. It should be read by everyone. We often wonder what becomes of the immense amounts of materials that are sent to the armies fighting in France. That it does not entirely disappear and become lost to the world is told in an article entitled *The Junk-Men of the War*, which is illustrated by a number of suggestive photographs. The paper on *Present Day Problems of Plant Culture* is concluded in this issue. A purely scientific paper is *Observations on Dropping*, which deals with the measurement of surface tension of liquids. There are interesting papers on *Psychotherapy*, on *State-Aided Research*, on the *Small Manufacturer* and on *World Economics Now Being Studied in Germany*.

Rapid Tanning Process

A NEW method which is said to be very rapid for use with all kinds of hides, has been brought out on the Continent by F. Gillardini, and consists in the use of a suitable tanning solution whose strength is considerably higher than usual. The solution is brought into a chamber under pressure and is applied to one side of the hide to be treated, while the other side of the hide undergoes the action of a vacuum or is simply kept at atmospheric pressure.

Camouflage in Seal Hunting

FROM Donald MacMillan, the Arctic explorer, we learn that camouflage exists even in the far north, thousands of miles from the battle-torn fields of Europe.

A typical case of northern camouflage is presented in the accompanying view, which shows a young seal hunter of Etah, Greenland, crawling up behind his prey without attracting its attention. Making use of a diminutive sled carrying a sloping screen and his repeating rifle, he works his way to within easy rifle shot of the unsuspecting seal.

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Seal hunter of Etah, Greenland, resorting to camouflage in his work

New Faces for the Shell-Torn Faces of Soldiers

WERE it not for the remarkable advances made in surgery during the present war, the countries long engaged would be largely filled with mutilated men. Indeed, each country would be faced with the problem of taking care of tens of thousands of human wrecks who form part of the invariable aftermath of all military campaigns.

Fortunately for the human race, however, surgery has easily kept pace with the destructiveness of warfare. The percentage of permanently crippled and helpless men turned out from modern military establishments is constantly decreasing, until it would seem that the proportion has been reduced to a minimum.

A recent case in point is the work now being done by Mrs. Anna Coleman Ladd, a well-known sculptor and member of the National Sculptor Society of New York and the Boston Society of Artists. Mrs. Ladd is presently hard at work in her Paris studio, aiding surgeons remake shell-torn faces of soldiers. Much of the remarkable advance in surgery has been in this direction, and this and other sculptors have joined hands with the doctors in working out the reconstruction of the shattered faces of war heroes. Often, when the jaw is badly shattered and the nose completely torn away, while the rest of the face is mutilated apparently beyond all hope, these skilled doctors and surgeons come to the rescue and perform the miracle of remaking the face almost as good as new.

It is reported that Mrs. Ladd, famed as a sculptor of unusual talent, has achieved miracles which the American Red Cross has been quick to appreciate and encourage. The accompanying illustrations offer the best possible evidence of some of her work, showing how the masks—made of copper and silver—are modelled to the proper contour and then painted the same color as the patient's face when once adjusted in place.

When a Periscope Does Not Mean a Submarine

AT the first sign of a periscope, merchant ships and destroyers were formerly instructed to alter their course and make straight for the hidden U-boat. Indeed, ramming was considered a most efficient method of sending many a German submarine to its doom. But knowing only too well the ramming tactics of the Allied sailors, it did not take the Germans long to turn this form of attack to their advantage; this they did by introducing the periscope mine.

Equipped with one or two periscope-like members, the decoy mine is a most fiendish device of destruction. It floats about the sea with only its periscope members showing above the surface, and as likely as not many a vessel has been tempted to ram it in the belief that the periscopes belonged to a U-boat. And in several such cases the results must have been disastrous, judging from the fact that the mine contains several hundred pounds of high explosive. The periscope members, as a rule, contain the detonator, although ordinary mines with detonator arms or "horns" are also equipped as periscope mines.

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Metal mask which covers the shell-torn face of a former soldier

Any *ruse de guerre* has a very limited life. The element of surprise is generally the main factor in its success, and when the enemy once discovers the nature of the ruse its value is soon nullified. So with the periscope mine: surface craft no longer ram what appears to be a U-boat, unless they are reasonably sure that they are not dealing with a decoy.

A Solution of the Coal Problem

WITH the price of coal nearly doubled during the past year, it is interesting to find that one of the scientific bureaus of the Government has analyzed the coal situation from a new viewpoint, and offers a practicable means whereby the householder may eventually obtain his domestic fuel supply at a fraction of what he now pays. How this may be accomplished is set forth in a little pamphlet, "Coal: the Resource and its Full Utilization," by C. G. Gilbert and J. E. Pogue, just issued under the direction of the Smithsonian Institution.

The gist of the plan lies in the fact that ordinary soft coal, instead of furnishing heat alone, and in criminally wasteful fashion at that, can be made to yield five products—artificial anthracite, gas, ammonia, benzol and coal-tar—all of commercial value. It is proposed that the municipal gas plant, operated as a public utility, be so enlarged as to treat all the coal ordinarily used by the community, with the production of these five commodities. By thus centralizing the utilization of coal and employing all the values contained in it, such economies may be effected as will most surely yield a really cheap domestic fuel.

The present paper does not attempt to set forth the exact methods whereby these results may be attained; the procedures remain to be worked out in detail. It merely presents the line of attack, and shows that there are no serious engineering obstacles in the way. If the matter can enlist sufficient public interest to create a strong demand for such a development, the American people may look forward to a far more satisfactory supply of domestic fuel than it has ever enjoyed in the past.

A limited edition of the Gilbert-Pogue report is available for free distribution, a copy may be obtained by writing to the United States National Museum, Washington, D. C.

Density of Blood

AT a recent meeting of the Académie des Sciences, Professor Richet presented an account of a series of researches made by Dr. Saint-Girons upon the relation which exists in case of war wounds or grave loss of blood, between the density of the blood and the amount of the same which has been lost. According to the author, the density of blood diminishes as the loss of blood becomes greater. He finds a method by which a rapid estimate can be made of the density, all that is required being to take out a drop of blood and place it in a vessel containing two superposed solutions lying on the extreme limits of density, *i. e.*, chloroform upon vaseline oil, and the drop will take up a position of equilibrium at the dividing line of the two liquids, its height depending on its density, and a good estimate of the density can thus readily be made.

This in turn gives a fair idea of the amount of blood lost by the person, as above stated, and this indication is of great value in deciding at just what moment an operation of transfusion of blood should take place. These results are applicable to all cases of accident to an otherwise healthy person.

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An American sculptor, Mrs. Anna Coleman Ladd, putting the finishing touches on a facial mask

Both these war heroes are provided with masks of metal to take the place of their shell-torn faces

World Markets for American Manufactures

Conducted by WILLIAM W. SNIFFIN

A department devoted to the extension of American trade in foreign lands

The Present Standing of Foreign Trade

THERE has been a disposition to take a rather pessimistic view of the immediate outlook for our foreign trade. The Government has power and facilities of absolute control over imports and exports, the transfer of gold and credits, and transportation on both land and sea. Nevertheless, the pessimism of a few exporters does not seem to be the prevailing opinion. On the contrary, many of the most thoroughly informed believe that, except for an occasional minor setback, our trade with foreign markets will continue to increase.

Quite recently there was announced the organization of a corporation financed by some of the wealthiest interests in America for the purpose of transacting foreign trade. The attention of the prospective manufacturing exporter was called to the fact that the preparatory work of selecting suitable lines, of establishing preliminary relations, of offering actual samples of merchandise and making necessary revisions—all these things required time. The fact the manufacturer is probably busy now is a potent reason for securing an active business a year from now. That he may be selling goods abroad now is another reason for making further connections. The prevalent belief that practically all shipping of non-war supplies is impossible is not well founded. There have been weekly, fortnightly and monthly sailings from New York, Philadelphia and San Francisco to all parts of the world, and export shipments, exclusive of munitions and grain, have largely increased.

Announcement was only the other day made of the establishment of a discount bank in New York city, capitalized at $2,000,000, to deal in prime bankers' bills and acceptances. This bank has led to consideration of the advisability of establishing others for the same purpose, thereby demonstrating the immediate need of preparing for the future and the actual demands of present business.

Now is the time, not after the war, for American business men to wake up and lay plans for the reconstruction of trade relations with Europe, which must follow the declaration of peace. Ideal trade relations never existed before, because of the isolation that was permitted between Great Britain and America. Now we have broken that isolation. We are building an enormous mercantile marine. We are extending consular facilities and putting commercial attachés in our American embassies. The Government is going to take more interest in American foreign trade.

Government regulations are not intended to limit foreign trade, but merely to direct it. The restrictions on imports are not absolute; there is not an article on that list whose importation is entirely prohibited. All of the articles on the list can be imported from Mexico and from Canada, where their transportation does not involve any ocean shipment. Furthermore, with few exceptions, all these articles may be imported from Europe under certain conditions. There is ample tonnage coming back from Europe. But the necessity for speed in the transportation of troops and supplies is so great that it is deemed wiser to have those boats come back in ballast or with a small cargo than to take a few days to load on the other side and discharge here. However, there must be some ballast, some cargo for these boats, so it is permitted to bring in articles on the restricted list, provided they can be shipped from convenient ports and without delay.

The Government has no intention of using its power arbitrarily. It has, in fact, exercised only a small amount of actual restriction in the case of many commodities. The lists of articles which may not be exported or imported, at all are not only relatively small, but are made up chiefly of articles whose exclusion from foreign trade will have very little effect on the general trade of the country. Only with a few nations has all trade been entirely forbidden, and this has been for the purpose of withholding supplies which it seemed evident were in one form or another ultimately reaching the enemy. Even these restrictions are now being materially modified with some of the proscribed countries.

"Vanishing" Trade That Does Not Vanish

The growth of American trade abroad has been especially noteworthy in certain countries and many authorities consider it of permanent character. Thus, today the United States is buying and selling with Latin America to the extent of over one-half of Latin America's total purchases and sales. Of course, it is largely due to the elimination of Germany and her allies from the Latin American market, and the lessening export capacity of Great Britain, France, the Netherlands and other countries, that for the first time in the history of Pan-American relations, the United States has taken such a prominent part in Latin American trade. Yet in a way this trade represents a normal and steady growth; for in the last fiscal year before hostilities commenced, the United States bought and sold more with all Latin America than did any other one nation; she passed Great Britain and left Germany far behind.

Again, in the case of Asia, we supplied before the war about six per cent of the imports and in 1917 about fifteen per cent. Of the imports of North America, exclusive of the United States, we supplied in 1913 about sixty per cent and in 1917 over eighty per cent. Of the imports of Europe we supplied before the war about twelve per cent and in 1917 about thirty per cent, exclusive of the Central Powers.

Most of this great gain in our exports is to be found in manufactures, and most of the gain in imports is in manufacturing material. Manufactures form about eighty per cent of the total exports to the non-European world, while European demands for the battlefield have greatly increased the percentage which manufactures form of the exports to that continent. The total value of manufactures exported in the seven months ending with January, 1918, was $2,133,000,000 against $650,000,000 in the corresponding period preceding the war, an increase of 228 per cent. For the same period foodstuffs showed an increase of about 146 per cent and raw material a decline of about one per cent. On the import side the chief increase occurs in manufacturing material, which shows an advance of about 100 per cent during the war period.

It is true, that February, 1918, figures show a decline of some $56,000,000, as compared with the same month of last year; but the decline in trade with the Allied nations, with their large war needs, accounted for $51,000,000 of this. The cargoes sent abroad by the United States for its own troops are not included in any of these totals; all reference to them is withheld. Reports of tradè with the neutral countries of Europe also show heavy decreases in both exports and imports. On the other hand, trade both ways with neutral countries outside of Europe shows a consistent and enormous increase as compared with the same month a year ago.

The situation is clearly understood by careful observers of our foreign commerce. It is appreciated that in the midst of the present tremendous stimulation of war production, it should not be forgotten that the United States must have foreign markets if its industrial life is to grow and expand. It must be remembered that our exports of manufactures, even before the war began, had begun to exceed our exports of food materials. We must hold our foreign markets and we must realize that in order to do so we shall have to contend with sharp competition from the other great industrial nations of the world.

Working Toward a Peace Basis

Foreign trade is assuming to a large extent the character it will have after peace. Exports of firearms and explosives were reduced from $757,700,000 for the calendar year 1916 to $730,700,000 for the succeeding year, but the reduction in the figure for the month of December—from $61,600,000 to $29,100,000—is more striking. Exports of iron and steel, almost entirely for other purposes than firearms and explosives, were valued at $1,243,800,000 for the calendar year 1917, as compared with $871,300,000 for the preceding year. American machinery is in large demand in foreign countries, especially France and Italy, and heavy orders have recently been contracted for.

In addition to manufactured goods, increases in exports of many other commodities, notably domestic breadstuffs, mineral oils and meat, are marked.

The development of America's dyestuff industry on a large scale has taken place wholly within the period since the war in Europe began. In 1914, we imported $7,241,406 worth of dyes and chemicals, of which $5,965,537 worth came from Germany. In 1917, we exported, beyond our own needs, $7,153,689 worth. It is interesting to note that we are exporting dyes and chemicals to Germany's old customers—notably Spain, France, and India, as well as Latin America. This trade of course, is new practically *in toto*.

The Competition That We Must Meet

If the United States expects to retain anywhere near its present preponderance in foreign trade after the war, it must heed the fact that other countries are already making their plans to develop or retain their trade. Aside from whatever ideas the Central Powers may have and be able to put into effect, Great Britain and France are making extensive plans and are already applying them as far as possible. For example, Great Britain, it is announced, will establish an Overseas Trade Department, under which 16 trade commissioners will operate in various countries of the Empire. During the reconstruction period after the war no less than 3,000,000 men of Great Britain's armies alone will seek industrial occupation on their return home, in consequence of which there is likely to be an intensive competition between that Empire and ourselves, not only in our present foreign markets, but also in the United States. Obviously, our present Allies—and some of our enemies perhaps—will seek the United States as a market where prosperity has reached a high-water mark and where the purchasing power per capita will be greater than in any other part of the world. To compensate for the share in our own market which Great Britain and France can rightfully claim, for the purpose of paying back to us the billions of dollars lent to them, our manufacturers must sell their wares in every market that they can reach. In other words, association with two nations in a common financial and military enterprise has forced us to become world merchants, whether we want to or not.

Brazil will, in the near future, hold agricultural fairs which offer a rare opportunity for the introduction of American stock or fertilizers or fodder into that country. If we do not take advantage of them, other countries may. As a matter of fact, the Government, in all its control of foreign commerce, has consistently followed a policy of maintaining exports to South America at as high a mark as varying conditions would permit. If the plans of the Government for the mobilization of industry in North and South America are to materialize, a tremendous interchange of merchandise between the northern and southern continents must be permitted.

Our Regulative Policies

The War Trade Board, in pursuing a policy fixed along these lines, has endeavored, in promulgating regulations governing the exports from this country to the southern republics, to support production in those countries of the supplies of various sorts which are most needed here. Even coal, when the supply last winter was barely sufficient for domestic needs, was granted shipment to South America, in a number of instances, for the benefit of industries in those countries which otherwise would probably have been forced to shut down.

There are many South American products, that are

(Concluded on page 394)

Wanted—Some One to Represent

To the Editor of the SCIENTIFIC AMERICAN:

I take the liberty of addressing you with a view to eliciting if you can advise me regarding an appointment as foreign representative of American merchandise houses.

Your periodical is the only American publication which I can peruse in this part of the globe and if your goodselves are not in a position to give me any information of account, perhaps you could forward this communication to an advertising house who could take the matter up direct with the writer.

My object is to get in touch with manufacturing and merchandise concerns which are sufficiently interested in the export trade to the Far, Middle and Near East and might probably require full or part services of a traveling representative, if not at present, probably at a future date.

Having observed quite recently the nature of the advertising of some of the American houses, I might mention that such advertising does not always receive the results merited. This I may add is not due to the particular method of advertising adopted but is merely one of the idiosyncrasies associable with the Eastern mind. To derive the full benefit of business in the Eastern market, one must actually come in contact with the business people, not only the European trader but also the native dealer, the trade with whom is very extensive all over the East, as you are doubtless aware.

I may mention here that I am 32 years of age, British (Scotch) born and bred and have an excellent college education. I have traveled all over the East and been connected for the past six years with commercial and merchandise concerns located in the East and have a thorough knowledge of the sound business firms, both European and non-European, and fully acquainted with the houses that would be interested in the various manufacturers lines and could push them to the best advantage.

Any assistance you can give me in the direction required will be much appreciated.

WM. C. MCGAVIN.

General P. O., Batavia, Java.

Locating a Block In the Underground Mail Tubes

THE passage of the United States mail through the underground tubes of our large cities is not unaccompanied by the unexpected discontinuance of their operation. Interruption in the transportation of the mail from one point to another is undesirable, both from a point of efficiency and because of the monetary loss by the tube company (any interruption of the service is accompanied by a fine, which is in proportion to the length of time the tube remains idle). Therefore, the early resumption of the service is most desirable.

With all the known efficiency of the tube companies, blockage of the tubes will occur from time to time from different causes, seemingly impossible to prevent. Thus, for instance, a settling of the earth from heavy rains may cause a decided sag or bend in the heavy tube. Sometimes a loose nut or other fragment from the air-pressure machinery finds its way into the tube. In this case, unless the foreign substance is large enough to be pushed through the tube by a passing mail-laden carrier, a jam will result from the wedging of the object between the carrier and the wall of the tube.

A resumption of the operation of the tube becomes imperative with the least possible loss of time. If increased pressure of the air supply is insufficient to force the carrier past the obstruction, it becomes necessary to dig up that particular section of the tube.

The location of the blockage in a tube line, perhaps three-quarters of a mile long, seems an almost impossible task. Yet the tube company operating the various lines in Philadelphia utilizes, for this purpose, an instrument which is remarkable for its simplicity—not to speak of its accuracy, which makes possible the location of the obstruction to within a very few inches.

The illustration depicts a drum (a) which has been previously coated with a fine layer of soot by revolving over a lighted pan of oil-soaked waste; a tuning fork (b) which has a known vibration or tone; a diaphragm (c) connected to the mouth of the blocked tube by means of a piece of rubber hose (e). A pistol (p) is arranged with the barrel pointing into the tube.

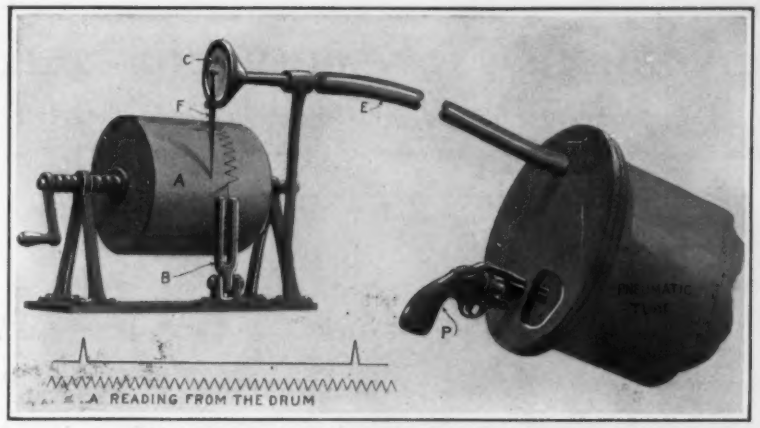
The tuning fork, when vibrating, scratches a zig-zag line upon the film of soot on the drum when the latter is revolved by means of the handle. The drum is set in a screw bearing which makes it advance as it turns and causes the lines to be recorded in a zig-zag spiral around the drum.

A pivoted arm (f) has one end fastened to the center of the diaphragm. The free end rests upon the drum and scratches a straight-line spiral alongside the zig-zag record of the tuning fork.

The apparatus is operated as follows: A violin bow is drawn at right angles across the tines of the tuning fork which is then lowered to rest upon the revolving drum. The pistol is discharged. The shock of the explosion causes the diaphragm to displace the pivoted arm sharply, thus recording a scratch at right angles to the long straight line. The sound of the explosion travels along the tube to the obstruction and then begins the return trip to the mouth of the tube whence it started. During this time the drum is steadily revolving, receiving upon its surface two lines; a zig-zag line from the tuning fork, and a line from the needle of the diaphragm, straight save for the single jog marking the moment when the revolver was discharged at the beginning of the recording.

When the returning echo strikes the diaphragm, it is again violently agitated. This movement of the pivoted arm breaks once more the straight-line record. Thus, the pistol shot begins the record by a break in the straight line and the return of the echo finishes the record with another break.

Now to compute the distance of the obstruction in the tube by means of the record obtained upon the smoked drum. Each zig-zag represents a known time interval and the last zig-zag represents the same length of time as the first one recorded, although, as the record proceeds to its end, the zig-zags are less pronounced, due to the motion of the tuning fork dying out. The distance the sound travels, in relation to the vibration of this tuning fork, has been predetermined and is figured out as 4.369 feet per vibration, when the fork vibrates in the note C. Thus, to find the distance the sound of the pistol shot traveled to the obstruction and back, it is only necessary to multiply the number of vibrations recorded between the two breaks in the straight line by the figure 4.369. Dividing the result by 2 gives the distance, in feet, of the obstruction from the mouth of the tube. This distance is measured on the surface of the ground and, invariably, the section of the tube dug up is the exact location of the blockade. The speedy replacement of the section of the underground tube allows the immediate resumption of "shooting" the United States mail underground from one sub-station to another.



The apparatus that tells where the mail tube is blocked

The several stages of an artificial eye

Artificial Eyes

BESIDES the artificial limbs the construction of which derives unwonted actuality from the present world war, the manufacture of artificial eyes has for some time been the order of the day. So far from being a mere esthetic question, this, in fact, is a matter of the highest practical, hygienical importance, a hollow socket being a continual annoyance to the patient, on account of the secretion produced by the drooping eye-lids, which is liable even to affect the sound eye.

Artificial eyes are manufactured in a rather interesting way. To the flattened end of a colorless, transparent enamel stick there is first applied the pupil, after which the iris is formed plastically by means of thin, sharpened, colored enamel sticks. Or else, an even more satisfactory, though more laborious process, the lines and circles of the iris are traced with the aid of pulverized enamel and well melted into the background.

An enamel tube of the color of the sclerotic and closed at the front end is then blown out ovally and pierced in front, the edges of the hole being, by means of a little stick of enamel, pressed uniformly round and slightly convex. The iris is now inserted into the aperture by means of the colorless stick and well melted in. After then melting off the enamel stick, so as only to leave the cornea, this is well rounded off and joined with the white of the eye. The veins which are always more or less visible on the white, are finally applied by means of a stick of red enamel.

In especially difficult cases, the surroundings of the eye, skin, eye-lids, etc., must even be imitated by means of glass parts, mounted on silver plates and fixed to the patient's eye-glasses. Such work, of course, demands the highest skill, but is done with such perfection that the imitation frequently can be detected only by the experienced eye of the expert.

Attempts have been made from time to time to manufacture artificial eyes of a less fragile material than glass (*e. g.*, vulcanite or celluloid), but no satisfactory results have so far been obtained in this connection.

The Mechanical Restaurant

IN the great electrical plant at Schenectady, N. Y., where meals are served to 3,500 employees per day, the dinners of five years ago are still possible at the same 25-cent charge, in spite of the persistently higher cost of living. This is made possible by skillful application of engineering principles in the kitchen and in the serving room.

Of the 3,500 meals served daily, 500 are breakfasts, 200 midnight lunches, 300 suppers, and 800 are delivered in the shops. This leaves 1,700 meals to be served during the noon period in the main restaurant building. The situation involved mechanical difficulties which could be met only by mechanical means.

The essential feature of the new service was the installation of a self-serving system, expedited by four conveyor belts. Under the old plan, fifty waitresses served approximately 1,000 meals, each waitress delivering food for twenty customers. With the new arrangement 1,700 men serve 1,700 meals—to themselves. The average time required by a customer, from the pay-as-you-enter cash desk till he is served and seated, is less than one minute. The procedure is as follows:

Promptly at the blowing of the noon whistle, four lines of men form in front of four cash registers to purchase their luncheon tickets. A cashier will make change and sell 29 tickets per minute. After the men file past the cash desk, they approach at right angles the end of one of the four belt conveyors. Adjacent to the nearer end of this is a station at which the ticket is exchanged for an aluminum tray. This is deposited by the luncher-to-be upon the conveyor, which moves it along the front of the food counter at the rate of 65 feet per minute, allowing the customer 15 seconds in which to select his food. Following his tray as it slides down the line, he helps himself, first to meat or fish, then to potatoes and tomatoes, next to pudding or pie, and finally to milk or coffee. All these articles are waiting for him on a hot steam table parallel to and behind the belt. By the time he has got all that is coming to him he and his tray are at the other end of the belt, where the checker O. K.'s the contents of the tray and permits the man to proceed.

After removing his tray of lunch from the conveyor the diner takes it to his seat. It is not exactly a reserved seat, but it is nevertheless an assured seat, because tickets are sold only up to the seating capacity of the big room. But the capacity of the restaurant is much greater than would be indicated by the number of seats, because many men have finished eating by 12.10, and gone away. Thus, one of the benefits of the system is that the trays, dishes, silver and glasses used by early arrivals are promptly

(*Concluded on page 394*)

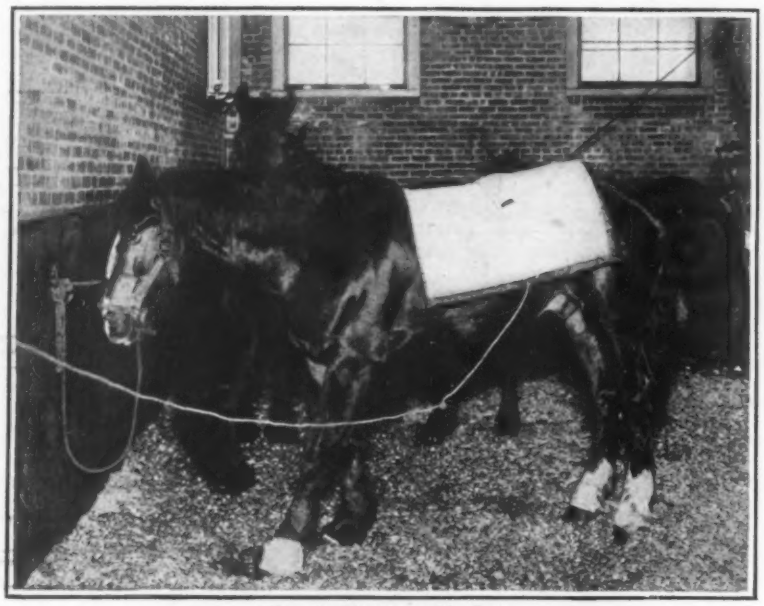
The restaurant at which the conveyor belt serves thirty men per minute

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Keeping Dobbin Warm by Electricity

PERHAPS the day is coming when, unless we wish to have the humane society on our trail, we shall find it necessary to provide old Dobbin with an electric blanket to withstand winter's icy blasts, especially when he feels slightly indisposed. The blanket is provided with a heating element which provides a grateful warmth without at the same time causing danger of burning the animal, or fire. The electrically heated blanket is particularly useful when the veterinarian prescribes hot applications. It can be used with lighting circuit, and the blanket may be fastened in place as desired.



The electric horse-blanket

A Life Saving Shovel

A NEW type of trenching-tool cover is suggested by two members of the Army Medical staff. This cover is designed with several strong "snaps" by means of which it may be fastened to the front of the soldier's blouse or coat, at the left, as shown in our illustration. In this way the trenching tool becomes automatically, when not in actual use, a protective shield for the heart, aorta, and a large section of the lungs, and should prevent a considerable number of wounds in these vital spots.

In addition to its protective feature, the following advantages are urged for this outfit. It has the same color as the uniform of the soldier; it does not add to the equipment carried; it can be easily and quickly applied; it can be attached without difficulty to the uniforms of men now in the field, the only thing necessary being the sewing on of the female snaps; it does not impede the walking or even the running ability of the soldier to any extent which would be a drawback in actual service; it does not interfere with the handling or the aiming of the rifle; after an advance has been made in the face of hostile rifle or machine-gun fire the trenching tool is at hand for trench work or removal of earth; it is an even stronger protection against the stab wounds of hand-to-hand fighting than it is against bullets. On every ground it seems that this device should impart confidence and effectiveness to the soldier, whether in the trenches or engaged in an advance. Perhaps it will also add a touch of novelty in our current fiction; the photograph of discarded sweetheart and the pocket testament are pretty well played out as providential bullet deflectors.

The idea of employing the intrenching tool as a shield is an excellent one. In fact, the use of body armor is so common in the present war that the practice is encouraged wherever it does not conflict seriously with the free movement of the soldier going about his task.

The spade that snaps on over a soldier's heart to protect him from light fire

When the Jack Will Not Do

A JACK is a fine thing to have in a car when it breaks down or loses a tire on the road. Sometimes it is equally in place in the garage; but on the other hand, there are many occasions when it is not appropriate for indoor repair work—occasions when it would prevent ready access to the affected part. In such emergencies, the harassed garage man, it would seem, can hardly hope to find a better substitute for the jack than that afforded by the hoist which we illustrate herewith, and which has been devised by an automobile repair man of Springfield, Ill. It will be noted that the hoist occupies a small area, that it can be taken off the busy part of the floor when not in use, and that it is hardly possible for it to be in the way of the man working on the car to which it has been applied.

A Bath Tub for the Eyes

UPON consulting an eye-specialist some time ago, Friedrich Maier, of Elizabeth, N. J., was advised to bathe his eyes frequently in cold water. He soon found that these baths were very effective, but the primitive way of taking them did not appeal to him. So he made a pair of miniature bath tubs for his eyes, fitting them to the curve of the head, and equipping them with inlet and outlet passages so that with the aid of a small rubber tube he was able to conduct the water direct from the faucet to his eyes and back to the drain without the inconvenience of putting his head in the water.

After using his eyewash cups for some time with the best of results the inventor put a pair in the hands of the director at the local eye clinic, who found them of excellent service. When foreign substances such as lime, acids or poisonous gasses enter the eyes, and continuous washing with fresh water is essential, some such device as this affords the best means of meeting the situation.

A hoist for use where a jack would be in the workman's way

This eye washing device is made of good, acid-proof material. The cups are provided with glass fronts, so that the doctor or the patient can observe the action of the washing liquid; and especially advantageous is the fact that application may be made in any position whatever, and with one or both cups at a time. The water can be led direct from the faucet, or, if a special solution is to be used, from an elevated reservoir as shown in the cut.

British Patent Bill

By E. B. Marshall

WITH the increasing need of greater efficiency in the manufacture and distribution of essentials at a time when the waste of war has seriously taxed economic conditions of the world, it is not surprising that society looks with favor on amendments in our laws which give any promise of the elimination of waste or the changing of conditions which will permit the speeding up of industrial activities.

Great Britain has had before her for a number of years a most serious question relating to the introduction of new methods and industries, the steps in the carrying out of which form the subject matter of British patents. The owners of many British patents have used their patents to prevent the introduction of inventions in Great Britain while carrying on the manufacture elsewhere in sufficient quantities to supply the British public needs with imported goods. While these methods may be in the interests of the patentee, it has been found by sad experience that they are not in the interest of Great Britain, for it is obvious that one of the principal reasons for the enactment of patent acts is the encouragement of industrial progress, and when a patent act of a country can be taken advantage of to throttle the development of an industry in a country, one of the chief objects of the patent act is defeated.

While for years British lawyers have been aware of the need for some patent legislation which would encourage the British manufacture under patents granted in Great Britain and which would prevent the use of the patent act to retard industrial growth, conservatism and the dislike which British lawyers have to anything which suggests a penalty, have made amendments hitherto enacted mild in character and their construction such that the amendments have failed to remedy the wrong which was possible under the old law. But, while this spirit of conservatism has been the cause for delay, it has nevertheless avoided the obnoxious "working" provisions of the patent acts of some countries

(Concluded on page 395)

Giving the eyes a medicated bath in individual bath-tubs of their own

Now, A FISK TIRE

for every motor vehicle that rolls

TRANSPORTATION, the nation's vital present day need, looks to the motor truck to help solve its problem.

Tires of brutal strength are demanded to carry without delays merchandise that *must* be delivered on time.

The Fisk Solid Truck Tire is built to meet this demand. It is a tire built to perform the hardest and heaviest work that solid tires are called on to withstand.

Here is a tire that must be reckoned with, and users of motor trucks must look at it squarely.

Made by a Company with a nation-wide branch distribution and an established reputation for quality and fairness.

To be the best concern in the world *to work for*, and the squarest concern in the world *to do business with*—THE FISK IDEAL

FISK SOLID TIRES

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

BELT BUCKLE.—J. M. GILLIGAN, Box 268 Rockville, Ind. The invention has for its object to provide a belt buckle wherein the ends may be quickly and easily connected and detached, and wherein the said ends are yieldingly connected. Springs are arranged in the metal clip belt ends to prevent undue pressure on the body.

SKIRT.—J. MEYER, care of Meyer Skirt Co., 1107 Broadway, New York, N. Y. The object of this invention is to provide a skirt or petticoat arranged to permit convenient donning, also devoid of any placket liable to open when the garment is worn. Another object is to provide pockets in the garment, the openings of which are inconspicuous and hence do not detract from the general appearance of the skirt.

BUTTON ATTACHING DEVICE.—E. F. SILKMAN, Fort Sherman, Canal Zone. The prime object of the invention is to provide a button engaging device such as to permit of ready and quick attachment and detachment of buttons to and from uniforms and civilian clothing of washable nature, the invention adapting itself to other uses, however, even though of less practical importance.

Electrical Devices

PHASE-ADVANCER FOR DYNAMO-ELECTRIC MACHINE.—G. KAPP, University of Birmingham, England. The object of the invention is to provide a phase advancer adapted for use, more especially with rolling mill and other like motors which are designed to slow down under load sufficiently to permit energy to be obtained from a flywheel. The invention comprises the employment with each of the secondary phases of a dynamo machine the field of which is produced by current passing through separate field windings from each of the secondary phases, and the armature of which is in series with one of the secondary phases and the corresponding field winding.

TRANSMITTER.—E. H. LOWE, 605 12th St., Modesto, Cal. The invention relates to improvements in telephone transmitters. An object is to provide a transmitter in which the resistance varying elements are disposed in a vacuum chamber, the latter being connected to the diaphragm, and transmitting the vibrations of the diaphragm to the resistance varying members, the device consists of but few parts therefore is not likely to get out of order.

Of Interest to Farmers

GRASS DESTROYER.—W. B. PETSON, R. R. 1, Niagara, N. D. The object of the invention is to provide a machine for uprooting grass, and cleaning it from soil in order to destroy the grass. The machine is drawn through the field behind plows to plow up the grass which is caught in the teeth of rollers, carried up to the dirt dislodging device, consisting of toothed rollers, where the dirt is thoroughly loosened from the roots of the grass, and the clean grass delivered to one side of the machine.

PEA AND BEAN SEPARATOR.—J. F. PRITCHARD, Elizabeth City, N. C. This invention relates to a machine for harvesting and threshing peas or beans, the machine is adapted to be drawn over a field and is provided with suitable guide elements to direct the vines of a row properly to the machine, there being a beater revolving in the machine transversely to the direction of travel and arranged to strip and thresh the peas or beans, together with means to deliver the threshed peas or beans rearwardly to an elevator conveying them and the chaff to separating and screening devices

HAY RACK.—W. E. JENTZ, Platteville, Wis. The invention relates to racks adapted to be mounted on a wagon, it more particularly relates to fastening means for U-bolt clamps employed in securing the rack to sills or equivalent supporting members. The fasteners have formed thereon at one end an eye through which a leg of the U-bolt clamp passes, the fastener at the opposite end having a transverse hole which in practice receives the transverse rod on which the ladder of the hay rack is mounted so that the tightening of the nuts on the rod will serve to hold the fasteners rigidly in position on the sills, whereby the U-bolt clamps are held against displacement.

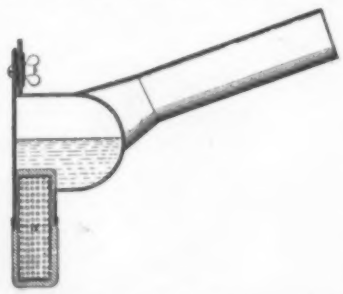
IRRIGATING APPARATUS.—J. L. PENNINGTON, Tonopah, Nev. An object of this invention is to provide a combined dam and water elevator which may be used in connection with flowing streams, and by means of which the water from the stream may be elevated and delivered to the surrounding country, during flood time the device may be raised, and lowered when the flood has passed, so as to be in position to dam and elevate the water for distribution.

HOG-YOKE.—C. S. WAYBRIGHT, 811 Burwell Ave., Staunton, Va. The invention has for its object to prevent hogs from creeping through or under a fence and without injruy or discomfort to the hog, the device is so arranged that the animal cannot become caught or hung in the fence bushes or the like, and will in no way interfere with the hog's eating or lying down, and it may be so adjusted as to fit any hog.

Of General Interest

PROTECTOR FOR BABY CARRIAGES AND THE LIKE.—ANNE FERNBACH, 9 W. 97th St., New York, N. Y. The object of this invention is to provide a protector for use on baby carriages, bassinets and the like, arranged to permit of quickly and conveniently placing the protector in position and fastening it in place to protect the baby against flies, mosquitos and other insects and also against the force of strong winds.

WALL CLEANING AND SIZING APPARATUS.—A. BLUMENTHAL, 4368 Richardson Ave., Bronx, N. Y. The invention relates to fountain brushes, and its object is to provide a wall cleaning and sizing apparatus more especially designed for quickly renovating slightly soiled rooms. The result is accomplished by the use of a handled



SECTION SIDE ELEVATION OF THE APPARATUS

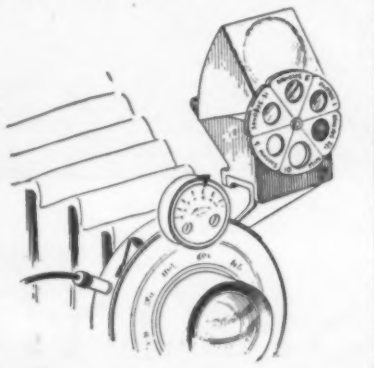
reservoir adapted to be filled with liquid and provided with an opening extending the entire length of the reservoir, and an applying member fitting into the opening, an inner portion extending into the reservoir and an outer portion projecting, the applying member comprising a receptical and a fabric covering inclosing it.

ICE-CREAM CONE DISHER.—N. PEPIN, 172 Lincoln St., Woonsocket, R. I. The invention relates to an ice cream scoop especially adapted for molding ice cream into conical shape. A specific object is the provision of a mold made in two sections, there being novel means to loosen the ice cream from the wall of the mold, and to open it by throwing the sections apart, whereby the conical body of ice cream can drop point downward into an ice cream cone.

PAPER DOLL'S DRESS FASTENER.—ALICE G. WILT, address A. C. Wilt, 617 W. Hoother St., Germantown, Philadelphia, Pa. The object of the invention is to provide fasteners for paper dolls' dresses having horizontal tabs extending from the sides of the dress and which are secured together to form a loop in the rear, through which the body of the paper doll may be disposed, the dress being also provided with tabs extending from the shoulders and bent downwardly over the shoulders and disposed in openings in the horizontal tabs.

CARD RETAINER FOR CARD CASES.—L. W. HUNTER, 169 Union Ave., Irvington, N. J. In this invention in order to accomplish the result, use is made of a card retainer having a base plate fastened to the back cover of a card case, this plate having at one end a transversely extending guideway and retaining flanges adapted to hold the cards between them and provided with angular arms slidably engaging the guideway to permit of adjusting the retaining flanges toward or from each other according to the width of the cards to be held in place.

EXPOSURE METER FOR CAMERAS.—J. P. HOWIE, Laurel St., Columbia, S. C. The objects of this invention are to provide a simple device which may be attached to the view finder of a camera by means of which the proper time for exposure of an object in light of any intensity,



A PERSPECTIVE VIEW OF THE DEVICE, AS APPLIED TO A FINDER

may be indicated, to provide a device in which a rotable disk is attached directly to the view finder by means of which the proper time of exposure may be quickly and accurately ascertained. The device is light in weight and convenient to manipulate.

TANK SIPHON.—F. G. RUF and W. KLESIUS, address, F. G. Ruf, 27 E. 7th St., New York, N. Y. The object of the invention is to provide a tank siphon particularly adaptable for water closet tanks. The device consists of a siphon in the shape of an inverted U having a shorter leg and a longer leg, a piston in the shorter leg, a belle-crank lever having an arcuated extension from the longer arm of the bell crank lever, a connecting rod uniting the arcuatedextension to the piston and flexible means engaging the shorter arm of the bell crank lever for operating the same.

BUILDING ELEMENT.—S. GROSSMAN, care of Grossman Bros. and Rosenbaum, Willow Ave. and 133d St., New York, N. Y. This invention relates to fireproof building construction and has particular reference to stair treads or other building units. Among the objects of the invention is to provide a substantially flat building unit adapted for stair treads, and comprising a base or shell made of relatively thin metal, but so formed as to possess maximum strength and minimum weight, the shell being provided with a body or filler of any suitable material.

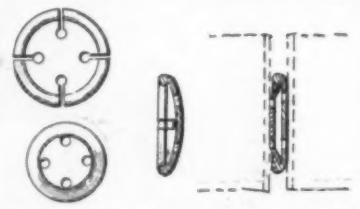
PACKING DEVICE.—F. PRUYN, address A. Moir, 161 Chamber St., New York, N. Y. The object of the invention is to provide a packing device especially designed for the transportation and storage of eggs, fruits, and other articles, and arranged to permit of quickly placing the articles in position, to reduce to a minimum cracking or breaking the eggs, or bruising the fruit during transportation or handling, and to prevent spreading contamination from one article to another in the package.

CONSTRUCTION OF SHIPS' HULLS.—F. S. PENDLETON, Pendleton Bros., 130 Pearl St., New York, N. Y. The invention has particular reference to the construction of hulls from the combination of wood and metal. Among the objects is to improve the construction of a hull with respect to the amount of storage space provided and the facilities for access to all parts of the hull, also to provide for ample rigidity and strength.

CURTAINED SPRAY AND SHOWER BATH.—J. A. EATON, Hotel Lenox, 6314-16 Dorchester Ave., Chicago, Ill. One of the principal objects of the invention is to provide a shower bath and spray, in the form of a curtained framework adapted to be detachably secured upon a bath tub of ordinary construction, and without the requirement of any fitting or plumbing in setting up the device. Means are provided for securing the framework to the bath tub.

HOLLOW BUILDING BLOCK.—G. W. LENKERD, Indiana, Pa. Among the objects of the invention is to provide a hollow building block having an exterior surface grooved so as to form a wall resembling in appearance an ordinary brick wall with respect to mortar courses, provision is made for producing a building block, with comparatively thin side walls, having exterior grooves, which possesses the requisite strength without increasing the weight.

BUTTON SNAP FASTENER.—G. FLESSA, Hotel Shattuck, Berkeley, Cal. The invention relates particularly to snap fasteners of button shape, the object is to provide a fastener which may be utilized without detriment as to appear-



INNER AND OUTER FACE VIEWS AND SECTIONAL VIEWS

ance or usefulness when either exposed or concealed, and one capable of presentation in several forms for use in connection with light, medium or heavy goods, of simple or elaborated design.

BUILDING CONSTRUCTION.—R. W. SCHWEIMLER and P. A. POULALION, care of R. W. Schweimler, 78 Porter Ave., Wheeling, W. Va. This invention has for its object to provide means in connection with floors and walls composed of concrete blocks, metal forms, gypsum blocks, hollow tiles or the like, for use as a guide or leveling point to assure a uniform thickness of floor, and as a support and nailing block for floor sleepers or the like.

TILE OR BLOCK.—R. W. SCHWEIMLER and P. A. POULALION, care of R. W. Schweimler, 78 Porter Ave., Wheeling, W. Va. The object of this invention is to provide a tile or block especially adapted for use in floors, partitions, furrings, conduits, flue linings, heat or vent ducts, and sewer pipes. The tile or block may be of any size and shape, and is composed of plaster of Paris, cement, ordinary ground blast furnace slag, and bituminous coal cinders. The composition is fireproof, waterproof and soundproof.

GROMET.—W. A. YOUNG, 198 Eleventh Ave., Astoria, L. I., N. Y. Among the principal objects which the invention has in view are to strengthen the construction of gromets, to increase the resistance to the abrasion to which gromets are subjected in service, to reduce the time factor in the construction and thereby to reduce the cost of gromet manufacture.

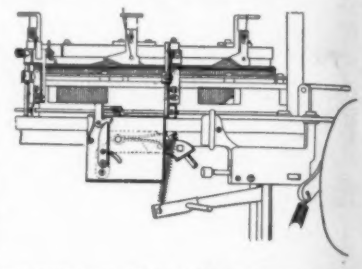
COFFEE, TEA AND MILK URN.—J. AUSUCUA, care of Miss E. Manzanilla, 200 W. 83d St., New York, N. Y. The object of this invention is to provide an urn more especially designed for use in hotels, restaurants, and other places serving coffee, tea, milk and similar beverages; it is arranged to permit the attendant to control the heating of the beverages to the minutest degree without danger of overheating or causing them to reach a boiling stage so injurious to the production of good coffee and tea.

MANUFACTURE OF VACUUM VESSELS.—H. BASTOW, 277 Crafton Ave., Crafton, Pa. The invention relates to the manufacture of vacuum bottles and similar vessels made of glass and having hollow walls, whereby such vessels of various shapes can be readily and economically produced, such for instance, as ordinary vacuum bottles or more squat-wide-mouthed vessels for containing food after baking it and sufficiently attractive for table use, or vessels for fireless cooking or the like.

SHOOTING GALLERY.—F. W. THOMPSON, 1690 Broadway, New York, N. Y. The object of the invention is to provide a shooting gallery arranged to require considerable skill on the part of the shooters to hit the distant target. To accomplish this use is made of a shooter's stand in the form of an aeroplane, and mechanical means holding the stand suspended in mid air and imparting a rocking motion thereto.

PUMP.—F. L. GOULD, 228 Sierra St., Reno, Nev. This invention has for its object to provide a pump especially adapted for use as a central station pump, to give impulse to one or more outlying pumps, or for use in series, to lift water through various successive stages, wherein use is made of a column of fluid as an agent of transmission of impulse from the power generator to the water lift cylinders.

AUTOMATIC STOP MECHANISM FOR KNITTING MACHINES.—C. R. OSTROM, SR., 817 Murray St., Portsmouth, Ohio. The invention is especially adapted to the stationary head or revolving type of needle knitting machines, it may, however, be readily adapted to almost any



SIDE ELEVATION OF PART OF A MACHINE PROVIDED WITH THE INVENTION

make or type of circular latch needle, knitting machines, the object is to provide a stop mechanism which in its action depends wholly upon the knitting machine itself without dependence upon external parts or apparatus.

PORTABLE DISH COLLECTING APPARATUS.—A. G. PSIAKI, 16 Exchange Place, New York, N. Y. Among the principal objects which the invention has in view are, to facilitate the handling of service table articles, to avoid physical contact with the articles when soiled, to avoid the necessity of placing the hands in the water in which the articles are cleansed, to avoid manual transportation of the articles, to separate the articles into allied groups, to provide a carrier in which the articles may be cleansed without removal, and to provide means whereby the classified articles may be cleansed in the selected groups.

SPRINKLING STOPPER.—E. L. ALLIS, Paris, France. The object of the invention isto provide a sprinkling stopper which cannot be tampered with, the stopper being designed more particularly for bottles containing liquid perfumes or other analogous products, it is characterize by the fact that it is internally provided with a screen the object being to prevent any fraudulent refilling the various parts which constitute the device can be assembled by flanging or hooking in a single operation.

FLUSH TANK VALVE.—E. R. HILL, New Albany, Miss. The invention relates particularly to bath and closet flush tank apparatus. Among the objects is to provide a type of inlet valve suitable for any standard closet flush tank or its equivalent, the valve is automatically controlled, of maximum simplicity, and may be easily and cheaply repaired.

CHIMNEY COWL.—C. W. MAC WILLIAMS Hutchinson, Kans. The invention has for its object to provide means in connection with pivotally mounted cowls adapted to be swung by the wind to discharge smoke in the same direction toward which the wind is blowing for automatically controlling the draft through the cowl in accordance with the speed of the wind, a damper is provided to partially close when the wind blows to lessen the amount of draft.

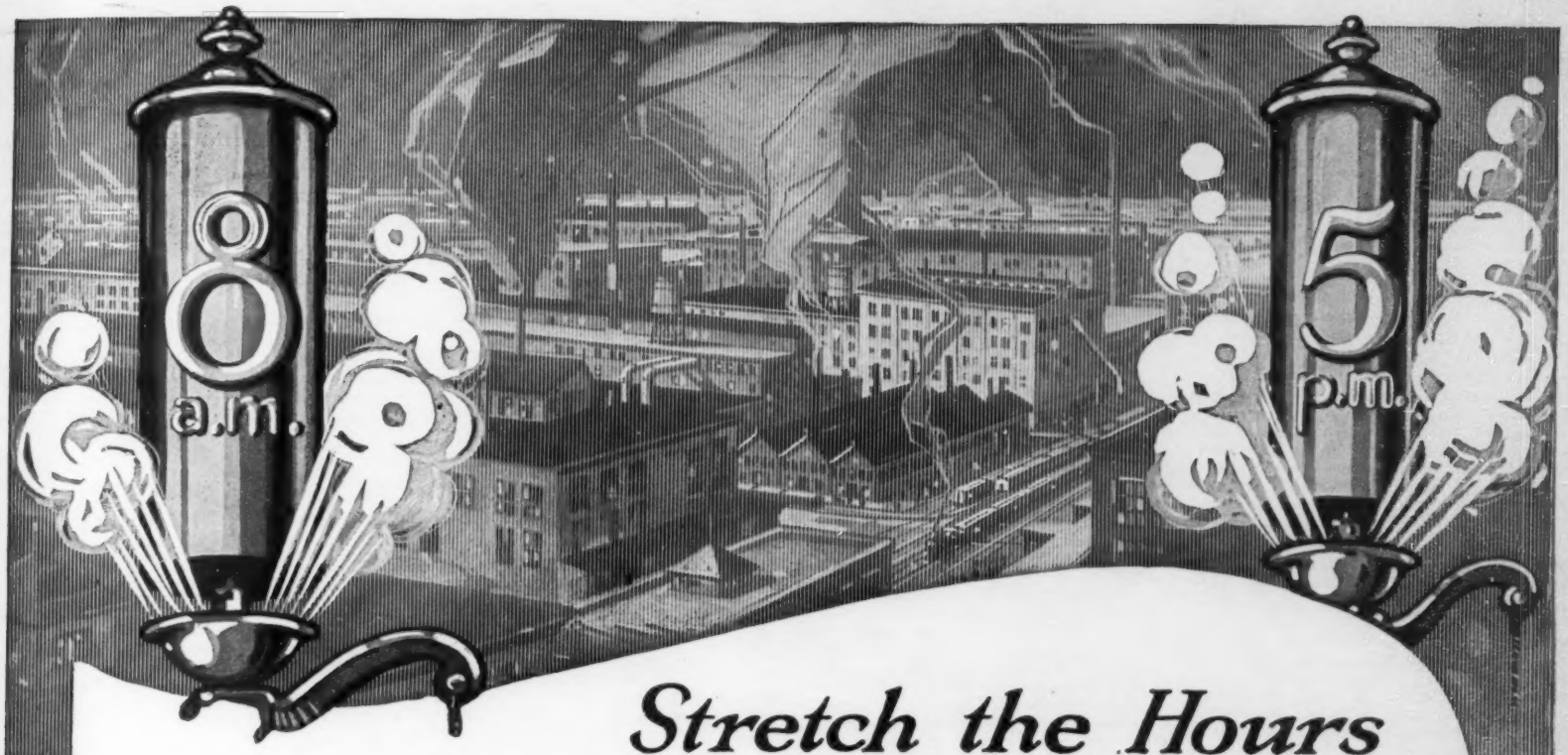
PROCESS OF METAL PLATING ALUMINUM.—W. J. TREVERS, 420 Park Side Ave., Buffalo, N. Y. This invention has particular reference to electro-plating and subsequent treatment of aluminum, whereby a perfect adherence is obtained between the aluminum object and the metal film deposited thereon. The process consists in cleaning the surface of the object electrolytically, then electro-plating it in an electrolyte containing nickel ammonium sulfate acidulated with boric acid, then drying the object thoroughly at a temperature of about 100 degrees, then subjecting the dried object to the action of heat which is gradually increased to a temperature not less than 240 degrees centrigrade.

PLASTIC COMPOSITION.—G. F. ARMSTRONG, care of Armstrong Rubber Co., 118 Adams St., Newark, N. J. The composition relates to a plastic mass which is used in pneumatic tubes to automatically fill openings that may be caused by puncture, thereby rendreing the pneumatic self-healing; the compressed air within the pneumatic facilitating the healing of the tube by the plastic mass. The plastic mass is viscous and adapted to remain in its original state for an indefinite period of time, not being affected by the atmosphere.

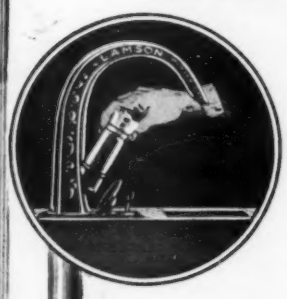
HORSE TWITCH.—H. W. MCCALL, Scotia, Neb. This invention relates to an instrument to be applied to a horse's nose to control the animal while administering medicine, shoeing or the like, and particularly relates to that type of device in which a loop is passed onto the nose or upper lip and then tightened so that the device is suspended in position. The device may be successfully employed in situations where a second man is not present or available to render assistance.

HEAT INSULATING COMPOSITION.—H. M. OLSON, Thomas Bldg., Santa Barbara, Cal. This invention relates to a plastic composition which effectively resists the action of heat. The object in view is to provide a composition made

(*Concluded on page 390*)



Stretch the Hours Between Whistle and Whistle!



THESE are the days that must yield a bigger output than ever before. Increased production is demanded of you from all sides, in spite of man-shortage, despite scarcity of equipment, in the face of a coal shortage. How can it be done? By a bigger, better and easier day's work from everyone in your organization within the usual working hours. Overtime means increased cost without increased profit. It means a worn out staff—so time must be saved. The hours between whistle and whistle must be stretched. How?

By Lamsonizing your office and factory. A Lamson Pneumatic Tube System will keep your whole force at profitable work while it automatically does the fetching and carrying. It will put orders, messages and information in black and white into the hands of anyone you please at telephone speed. It will carry small materials, drawings, blueprints or tools from one department to another or underground to the shop or warehouse in a distant corner of the yard. A Lamson Pneumatic Tube System is the mechanical organizer. It saves time and footwork. It doesn't drive help—but leads them into orderly, standardized performance.

Lamson accomplishment isn't a theory. It's a hard, cold, practical *fact*. Lamson Pneumatic Tube Systems carry papers and cash in thousands of huge manufacturing plants and department stores, every day. They shoot letters, job cards, time tickets, orders and requisitions to just the place you want them to go. They are speeding up production in a thousand different firms. They carry incoming and outgoing mail for Montgomery, Ward & Co. and the Otis Elevator Co. They carry requisitions or orders for tools and supplies for Endicott, Johnson & Co.—and deliver them with telegram accuracy. They never hesitate nor stop on the way. They never lose their message or package. They are never tired and can't get overworked.

If you think your plant can't go faster with the equipment and the force you now have, a look into the Lamson Idea will throw a new, strong light on the subject—to your advantage. A Lamson man is on call at your request. He won't try to tell you your business but he will intelligently explain a basic principle of organization.

LAMSON SERVICE

If you prefer, send first for our Tube Book—promptly mailed

THE LAMSON COMPANY
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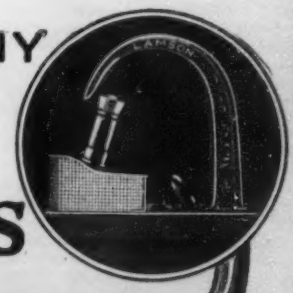


Lamson Conveyors

RECENTLY PATENTED INVENTIONS

(*Concluded from page 388*)

up of an infusorial earth and a binder which will insulate and resist the disintegrating effect of heat. The composition may be used in different ways, including the molding into commercial articles.

CIGARETTE HOLDER.—M. S. MACK, 15 Maiden Lane, New York, N. Y. An object of the invention is to provide a simple and efficient device the size of which is that of an ordinary cigarette holder and with which a cigarette can be ejected from the holder automatically whenever desired, in this device the air can only enter through the mouth of the holder where the cigarette is received, thereby eliminating interference with the smoking of the cigarette through the holder.

PROCESS FOR SOFTENING HIDES, SKINS, OR THE LIKE.—O. RÖHM, Darmstadt, Germany. This softening process consists in treating the hides or skins in a solution of water and 0.05 per cent enzyms of the pancreatic gland of animals and one per cent soda ash in water, the softening is mostly concluded in one day, all injury to the hairs and wool is completely avoided if the solution is sufficiently alkaline.

HYDRAULIC MOTOR.—J. O. KAVADER, Fort Bidwell, Cal. The object of the invention is to provide a hydraulic motor adapted to be operated under the pressure of a column of water representing the difference of levels of subterranean water strata. The invention makes use of a well casing extending from a lower to an upper stratum in which casing the motor is installed at the lower stratum, the motor comprising a cylinder and piston, and a valve controlling the admission and discharge of water to and from the cylinder, a valve rod being automatically controlled by the movements of a plunger rod operated by the piston.

GUIDE FOR INDEX CARDS.—C. C. SMITH, Exeter, Neb. A prime object of the invention is to provide a guide having jaws for receiving a label the jaws being so formed as to present an interior space to accommodate a label, the front longitudinal edges in close relation retaining the label, the jaws furthermore presenting end edges in close relation to prevent displacement of the label at the ends of the guide, the arrangement is such that the label may be readily entered and will be effectively prevented from accidental displacement.

BURGLAR-PROOF SAFE OR VAULT.—H. W. HELLER, 105 2d St., Portland, Ore. An object of the invention is to provide means which is dependent upon a time lock and an "automatic" device for dead locking the means which prevents the opening of the doors of the safe or vault Further objects are to provide auxiliary means for dead locking the door retaining means when the time lock and "automatic" device are in position to permit the release of the door retaining means, and to provide means for operating certain counter-weight door retaining means.

BOTTLE-STOPPER.—J. MENZIES, 220 S. 3d St., Wilmington, N. C. The invention relates more particularly to stoppers for temporary use for utilization in place of the permanent stoppers of sauce, catsup, and other bottles, having means whereby the fluid outlet may be readily and quickly cut off at any time, in order to prevent the drying up and deterioration of the contents of the bottle between its periods of use.

Hardware and Tools

COMBINED BORING TOOL AND COUNTERSINKER.—B. W. BERRY, 1250 18th St., Portsmouth, Ohio. The invention relates to a combined boring tool and countersinker, it has for its object to provide a device especially adapted for preparing piston heads to receive the plugs. The improved taps consists of two portions of unequal diameter. At the upper end of the tap is a shank similar to the shank for engaging the socket of the chuck which is in effect an extension chuck.

TOOL.—L. PIGNANI, address Samuel W. Miller, Blairsville, Pa. The invention relates to a combination tool and more particularly to a tool in which wrench elements and other tools are coordinated with the handle of a hammer or the like. The combination consists of a novel wrench assembly for the rear end of the handle of the hammer, the rest of the hollow space being filled by combination pliers, a double ended screwdriver blade and a cold chisel.

ADJUSTABLE TENSION SAW-GAGE.—T. N. JORDAN, Jr., Picayune, Miss. This invention relates generally to saw gages, and particularly to one adapted for use both as a straight edge, in connection with bandsaws to detect the effect of unequal tension there along, and as an adjustable tension gage for dished circular saws, the object being to provide a device, adjustment of which may be readily and quickly made.

UNIVERSAL CLINOMETER.—F. MLADINICH, 72 Shelbrook Place, Rockville, Center, L. I., N. Y. Among the objects of this invention is to provide an instrument, broadly in the nature of a spirit level, adapted to be applied to any surface, whether horizontal or inclined at any angle thereto, so as to indicate directly to the operator the angle or pitch of surface to which the device is applied. The invention may be applied upon or against any surface, such for instance as an overhead surface or a part of a machine or other device that is ordinarily inaccessible for use therewith of a spirit level.

Heating and Lighting

ARC LAMP FOR MOVING PICTURE STUDIOS.—W. BACH, and W. A. CUNNINGHAM, 164 W. 116 St., New York, N. Y. The invention has for its general object the construction and operation of apparatus so designed as to provide a substantially uniform distribution of light over a wide area, the lamp is composed of one or more units, the feeding mechanism is so designed as to insure a steady arc, this being a very important desideratum in moving picture work.

MOVABLE ENDLESS GRATE HAVING REMOVABLE MEMBERS.—P. COMET, and F. COULON, Bagnères-de-Bigorre, France. This invention relates to grates composed of a series of bars secured to endless chains and on each of which a series of members designed to support the coal are removably mounted. The grate may be moved either continuous or intermittent at the combustion of the coal goes on. The bars and members of a particular shape for the purpose of securing, by the automatic clearance of the air passages, the efficiency and the duration of the grate.

Machines and Mechanical Devices

SHAFT SUPPORT.—A. N. SAMMARONE, 18 Cuyahoga St., Akron, Ohio. An object of this invention is to provide a shaft bearing or support which is made of pressed sheet metal and which is provided with an oil well, the device having means for preventing the leaking of the oil from the oil well, the support may be applicable to any revolving shaft, it consists of two parts made of pressed metal and holding anti-friction lining or working surfaces.

METER.—S. G. F. HAAS, 59 Neron Place, New Orleans, La. The invention has for its object the application to water, electric and other meters of an epicyclic train of gears of small diameter, few teeth and differing but slightly in the number of teeth. This epicyclic train is to be used wherever and whenever it is necessary to greatly reduce the speed of the moving or measuring member and transfer this proportionally reduced speed to the recording or registering mechanism.

MACHINE FOR CASTING STEREOTYPE PLATES.—C. WINKLER, Berne, Switzerland. The principal feature of the machine is the instantaneous casting of the plate, that is to say, the molten metal runs into and fills the mold in the fraction of a second. The instantaneous filling of the form enables the use of molten metal of lower temperature than usual, there being no possibility of the temperature of the metal varying while flowing into the mold with this device, the metal flows into the mold in its entire width.

LOOP-FORMING MECHANISM FOR MOVING PICTURE MACHINES.—A. P. TABER, care of Standard Electric and Equipment Co., Red Wing, Minn. The invention relates to machines in which a top loop is formed between the supply reel and the upper feed sprocket and the bottom loop is formed between the intermittent feed sprocket and the lower take-up feed sprocket which feeds the film to the take-up device. The object is to provide mechanism arranged to permit of readily forming a loop, especially the bottom loop, in case the old loop is destroyed, and without stopping the picture machine.

COMBINED MANUAL AND POWER CONTROLLING MECHANISM.—L. IMBLUM, Bliss Electrical School, Tacoma Park, Washington, D. C. This invention relates generally to controlling mechanism for reversing gears steering gear shifts, and other parts to be controlled of this general nature, and particularly to a compact and effective arrangement of parts whereby to permit of manual control in case the power actuated controlling parts are disabled or the source of power fails.

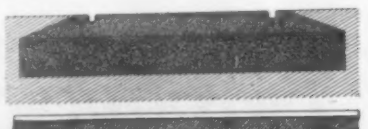
TANK FOR FLUSHERS AND SPRINKLERS.—W. K. SHELLY, care of Tiffin Wagon Co., Tiffin, Ohio. The object of the invention is to provide a tank arranged to supply the flusher and sprinkler with water for flushing and sprinkling purposes, and at the same time provide a separate compartment for containing the circulating water used for cooling the internal combustion engine of the sprinkler. Another object is to fill the separate compartment for the circulating water from the main compartment of the tank and to reduce the temperature of the circulating water at the time the water in the main compartment overflows into the circulating water compartment.

Medical Devices

ORTHOPEDIC TABLE.—S. TASCARELLA, 65 George St., Brooklyn, N. Y. The invention relates to what may be termed surgical tables, its object is to provide a construction especially adapted as an orthopedic table. Another object is to provide a table in which certain parts may be raised and lowered while others move back and forth at right angles to the part that is raised and lowered whereby all parts of the patient may be reached.

Railways and Their Accessories

RAILROAD CROSSING CONSTRUCTION.—H. H. COLLINS, 117 Jobe St., Johnson City, Tenn. The invention has for its object the provision of a crossing that will not harden and crack



TRANSVERSE, VERTICAL AND LONGITUDINAL SECTIONS

during cold weather nor become too soft in warm weather, and will maintain approximately the same degree of elasticity at all times, with enough resilience to overcome all shock and jar of passing trains, and will afford a waterproof cover for all the parts of the crossing, preserving the ties from decay and preventing the loosening of bolts and nuts.

EXTENSION GRIP FOR CARS.—H. E. DOODY, 2333 Bedford Ave., Brooklyn, N. Y. The invention relates to a hanger or grip to be employed in street cars and railway cars in lieu of the hanger strap, the grip is telescoping and adjustable as to its length to suit the reach of persons of different stature, there are novel means to permit of the extension movement when required.

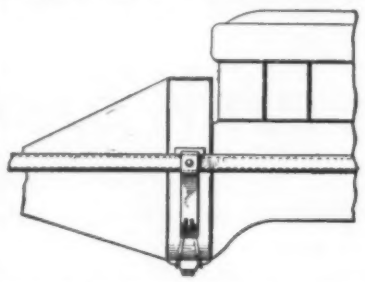
Pertaining to Recreation

GAME APPARATUS.—G. H. BAILEY, 8901 109th St., Richmond Hill, L. I., N. Y. The invention relates to game apparatus in which there is involved an alley or table structure having at one end a plurality of pockets, with which there coöperate one or more movable members such as disks. Among the objects is to provide a special form of movable disks, and a special type of pit coöperating with each of the pockets to receive the movable members.

Pertaining to Vehicles

DEMOUNTABLE WHEEL.—J. W. DICKINSON, 215 E. Capital Ave., Little Rock, Ark. An object of the invention is to provide a hub upon which the wheel is adapted to be easily and quickly mounted and detached, the novel construction of the hub and wheel also rendering the latter interchangeable so that they may be applied to both front and rear axles.

CRANK CASE SUPPORT.—F. A. GOOLD and W. G. BAXTER, Montfort, Wis. The object of this invention is to provide a crank case support specially adapted for attachment to Ford cars for supporting the crank case against downward



PARTIAL SIDE VIEW CRANK CASE, SHOWING SUPPORT

movement, wherein the support is connected to the frame of the vehicle and to the supporting arms for the crank case. The support is easily attached, and once attached, requires no attention, it is firmly held by bolts and nuts.

ENGINE STARTER.—S. C. FORRESTER, 29 Pickert St., Atlanta, Ga. The invention relates particularly to a mechanical engine started consisting of lever actuated connections including a lever adjacent the operator, with the usual starting connections of an engine shaft, whereby to start the engine from the operator's seat in an automobile, to which the invention is especially applicable, the object is to provide certain connections between the operating lever and the engine shaft neutralizing the effect of backfire, and allowing for adjustment of the leverage connections to compensate for the differences in action due to climatic variances.

AUTOMATIC NON-SKID DEVICE.—H. STERN, 15 E. 26th St., New York, N. Y. The invention relates especially to the wheels of motor vehicles. Among the objects is to provide means carried partly by and partly adjacent to the wheels for the purpose of applying over the treads thereof devices to prevent the skidding of the wheels with respect to the roadway, the device is under the control of the operator and may be brought into operation or removed therefrom while the machine is in motion.

DIFFERENTIAL TRANSMISSION. — H. HANSEN amd J. A. MONTGOMERY, Ukiah, Cal. This invention relates to transmissions of the fluid type, particularly adapted for use in connection with oil. An object of the invention is to provide a simple and efficient power transmission whereby various speeds and reverse motion may be obtained.

RESILIENT WHEEL.—M. GROSSMAN, 1018 E. 163d St., Bronx, N. Y. Among the objects of the invention is to provide a wheel having a spring rim comprising a circumferential series of radially disposed rounded or elliptical spring elements the entire wheel having an appearance very similar to an ordinary pneumatic tired wheel, the spring elements have knuckles at their outer portions, and a band surrounding the spring elements, with means for interlocking all the knuckles together, and providing a seat for a cushion adapted to have direct contact with the roadway.

SPRING WHEEL.—G. W. WATTS, 423 Main St., Hot Springs, Ark. The invention has for its object to provide a wheel especially adapted for use with heavy motor vehicles, but also adapted for general use on motor trucks, wherein an auxiliary rim is provided arranged concentric to the wheel and connected to the rim of the wheel by spring mechanism so arranged that shock or jar on the auxiliary rim will not be transmitted to the axle, but will be absorbed between the rim and the wheel.

GALLOPING WHEEL.—M. V. B. EVESSON, 670 Ocean Ave., Jersey City, N. J. This invention relates to a toy vehicle adapted to be propelled by a child while riding thereon. Among the objects is to provide a vehicle having a plurality of wheels, at least one of which the main wheel has a rim of an elliptical form as distinguished from the regular form, the vehicle together with the wheel being so designed that a child by skilful shifting of his weight or position, is enabled to propel the vehicle at considerable velocity and with not much energy.

FASTENING FOR HUB-COVERS AND THE LIKE.—M. T. DAVIS, Jr., address Kanawha Mfg. Co., Charleston W. Va. The invention relates to fastenings for hub covers, wherein the fastener is so arranged that the cap or cover of the hub will be held firmly in place, yet with some resiliency, and flush with or within the hub so that the thrust of the hub comes directly against the bearing box of the axle and not against the hub cover.

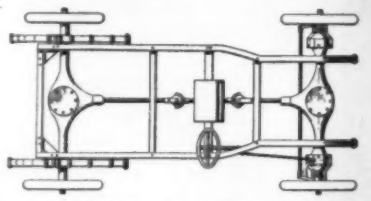
ADJUSTING AND LOCKING DEVICE FOR SKID CHAINS.—J. S. BOYD, address Cooper Sansom, Georgetown, Texas. This invention relates to anti-skid chains for use on automobile wheels and tires. The structure takes the form of a pair of longitudinally curved plates, each being provided at its outer end with a chain

A SIDE ELEVATION SHOWING PLATES IN ENGAGED POSITION

engaging hook, one of the plates being provided with a longitudinal series of openings and the other having a cam locking and adjusting lever so formed and engaged with the first plate that the lever is held in proper position in use by the various strains to which the locking device is subjected.

ARMOR.—H. HEIDE, Winslow, Ariz. The object of the invention is to provide armor for infantry, capable of shielding several men when advancing to destroy barbed wire fence or the like, wherein an arc shaped plate is provided having an inclined top and supported by wheels, the said plate having machine gun openings and shielded sight openings, and a saw capable of being operated from the inside for cutting wire.

FRONT WHEEL DRIVE FOR MOTOR VEHICLES.—B. J. COLLINS, Lenora, Okla. The object of the invention is to provide a simple, inexpensive and efficient mechanism, for connecting the motor directly with the front wheels



A PLAN VIEW OF THE DRIVE

of motor vehicles to provide a four wheel drive The spindles of the front wheels are connected to axle sections by universal joint connections and these axle sections are connected by a differential.

LINK BELT.—M. A. CHAMPLIN, care of M. M. BAKER, Holt Mfg. Co., Peoria, Ill. The invention relates particularly to those track laying link belts which are used with the so-called "caterpillar" tractors. An object is to provide a link belt in which the cushioning member is not subjected to the tremendous strain such as would be present were the cushioning member brought directly in contact with the ground, the cushioning members being placed between the wearing member and the body portion of the link proper.

HYDRAULIC TRANSMISSION.—W. L. ROUNDS, 64 Bellview Terrace, Rensselaer, N. Y. The general objects of the invention are to improve the construction and operation of transmission so that it is adaptable for automobile or other work requiring a varying amount of power to be easily thrown on or off by the paddles or impeller blades being adjustable to different angles, that is to say, by presenting the flat faces directly to the hydraulic medium or their edges thereto.

Designs

DESIGN FOR A BANNER.—K. A. KELLY, 251 W. 87th St., New York, N. Y. The invention relates to an ornamental design for a banner, which as shown in the illustration accompanying the patent, represents the American flag, the stars at the left hand upper corner, being displayed on the tri-colors of France, and the red stripes being formed by a series of Union Jacks of Great Britain.

DESIGN FOR A SPRINKLER HEAD LINK ELEMENT.—F. J. FEE, 2232 Andrews Ave., Bronx, N. Y. This ornamental design covers a unique configuration of link or plate having certain holding features but characterized by peculiar ornate outlines at its periphery.

DESIGN FOR A LAMP.—L. C. TIFFANY, care of Tiffany Furnaces, Corona, L. I., N. Y. This ornamental design for a lamp represents the budding form of a tulip, the entire design is of glass, the bud being shown in two colors and the base iridescent.

DESIGN FOR A DOLL.—LELIA M. FELLOM, 216 Grosse Bldg., Los Angeles, Cal. The designs as shown in the patent drawings represent the figure of a little girl at the front, and a baby bear at the back, the space between being filled with unbreakable material.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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"How warm you keep it here; must be 75 degrees; you don't care for Garfield's 68, do you? You certainly are shooting your drafts as if you never heard of a coal-shortage."

"No," said the invalid. "I'll bet you a box of cigars that if you go down cellar you'll find every draft shut and every damper open."

"I'll take you," replied his visitor, and went down to inspect.

When he returned he said, "Cigars are yours; every draft shut; every damper open. While it's zero outside, the thermometer on the newel-post says 74 degrees. But I've found why; you've got your boiler and pipes cased in '85% Magnesia' coverings."

"That's the secret," laughed the host. "And now here's the rest of that story:

"My next-door neighbor is a coal-dealer. Because I've been sick he offered to deliver me each week just the same amount of coal he allotted for himself. His house has just about the same heating space as mine, and he has the same kind of heater. But while he burns up his allotment every week, I've burned only about half of mine.

"He wasted because his boiler and pipes weren't properly covered; I saved because mine were covered with '85% Magnesia.'

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Steam-Pressure	5 lbs.	50 lbs.	100 lbs.	200 lbs.	200 lbs. with 100° superheat
B. T. U. *lost* per hour per sq. ft. of bare pipe	367	409	802	1058	1735
B. T. U. *saved* per sq. ft. per hr. by covering with "85% Magnesia"	298	510	676	905	1525
Tons (2240 lbs.) *Coal saved per year* of 8760 hours on 10,000 sq. ft. of pipe covered with "85% Magnesia"	1190	2080	2700	3620	5650
Car-loads of Coal saved, per year (40 tons per car) by "85% Magnesia"	30	52	68	90	140

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The Agricultural Revolution in the South

(Concluded from page 378)

intended to bring about the practice of crop rotation throughout the state. The farmer was told that if he were to reduce his cotton acreage and plant corn, oats, wheat, vegetables, legumes and other soil enriching crops, his cotton crop would be larger by virtue of improved soil and he would have the added benefit of the other marketable crops. The idea of this unusual campaign has been to make cotton the money-making crop and the other crops the expense crops. Formerly the average farmer was content to let cotton pay all his expenses, provide a living for the family and, if there was anything left, a small surplus for the bank.

Mrs. Mathis' work as an individual farmer has bordered on the phenomenal. A few years ago she went into the poor farming district of the state and purchased 1,000 acres of the poorest, impoverished soil she could find, paying $8 an acre for it. Two years later, after she had divided it into small tenant farms, practiced crop rotation and diversification of crops, she sold this same land for $40 an acre. In addition to this, she spent a large part of her earnings for the two years in rebuilding these farms.

The huge cotton crop grown last year in the cotton belt country is the best illustration of what modern farming is doing for the South. The enormous increase in the yield was produced on an acreage which had been reduced by more than 1,000,000 acres within a year's time, credit for part of which is due the scientific farming movement. In Alabama the cotton acreage was reduced by approximately 700,000 bushels, while Texas, Oklahoma and South Carolina also cut down the acreage planted in cotton to a considerable extent. The scarcity of labor, the ravages of the boll weevil and the demand for better farming were three of the causes contributing to this decrease in acreage. Despite this great reduction the southern cotton growers had the best year in their history.

Experts are urging the cotton grower to pay more attention to his seed and soil rebuilding than in planting increased acreages in cotton, even in the face of the serious world-wide conditions existing in the cotton market. It is estimated that, if diversified farming is practiced generally in the South for a period of three or four years, the cotton crop can be doubled without any increase in the acreage. In addition, with the splendid climatic advantages enjoyed, the southern farmer will be able to produce enormous quantities of corn and other cereals, for which there will be an unlimited demand for years to come. The possibilities for the cattle grower in the South will also be greatly enhanced, inasmuch as he will possess the advantage of the best climate in the world for year-round feeding and the unlimited facilities for the production of forage.

For these reasons the diversified crop movement in the South has assumed world-wide importance. The soil resources of the South are sufficient to enable it to feed as well as clothe a large part of the world, a double advantage which the progressive farmer of the South is now determined to turn to good account.

Strategic Moves of the War

(Concluded from page 380)

few days ago a strong offensive movement against the coastal part of the British front; it is reported that the British drove back the enemy with loss, taking prisoners and material. A second attack by the Germans against the lines east of the Jordan was also easily checked. A third attack on the lines astride the Jerusalem-Nabulus road met the same fate.

The present British front extends across Palestine from the Mediterranean to and slightly beyond the Jordan River about fifteen miles north of Jerusalem. On the Mediterranean the English have gone forward some distance north of Jaffa, the port of Jerusalem; this port is serving as a base of supplies and for sea communications; it is also connected by rail with Jerusalem. Recently the situation in Palestine has become quite desperate for the Turks so that German troops were sent to their assistance. The recent attempt against the English lines on the coast had the capture of Jaffa and the cutting of the railroad as objectives. The capture of German prisoners indicates for the first time that German trooops are now with the Turks. On the other hand, the recent remarks of the English Prime Minister that have been so frequently quoted indicate that the British have only two divisions of white troops in Palestine, the remainder of the army there being composed of Indian and Egyptian troops with a very small sprinkling of white troops.

If the Turkish-German forces now in Palestine attempt any strong forward movement, they will as a matter of strategy have to leave a powerful force behind them to oppose an advance of the British now on the Euphrates against Aleppo. The latter is the junction of the Bagdad and Syrian railways and its occupation would not only cut off entirely Turkish communications with Constantinople but would isolate also their forces operating to the south in Syria. The last reports place the British on the Euphrates about two hundred miles from Aleppo; but their recent advances have been very rapid and such a distance may not prove the protection it has been assumed to be up to the present time.

Wet Weather Painting

THERE is an old theory that paint should never be applied in wet weather, because it is less durable and more likely to wash off than paint applied in dry weather. This point has been the subject of some careful experiments conducted with raw linseed oil mixed with the usual dryers. This combination was spread on glass and kept in a current of dry air while protected from other reagents, and the air was freed from carbonic acid gas. The dry air was then made to bubble through alkali solutions of known strength in order to absorb any acids that might be produced during the oxidation of the oil. The amount of acid produced and the gain in weight of the oil film supplied data from which logical deductions could be made. When dry air was used the oil gained 18 per cent in weight and the acid production was very low, but when air saturated with moisture was used the gain in weight was 50 per cent and the volatile acid products were high.

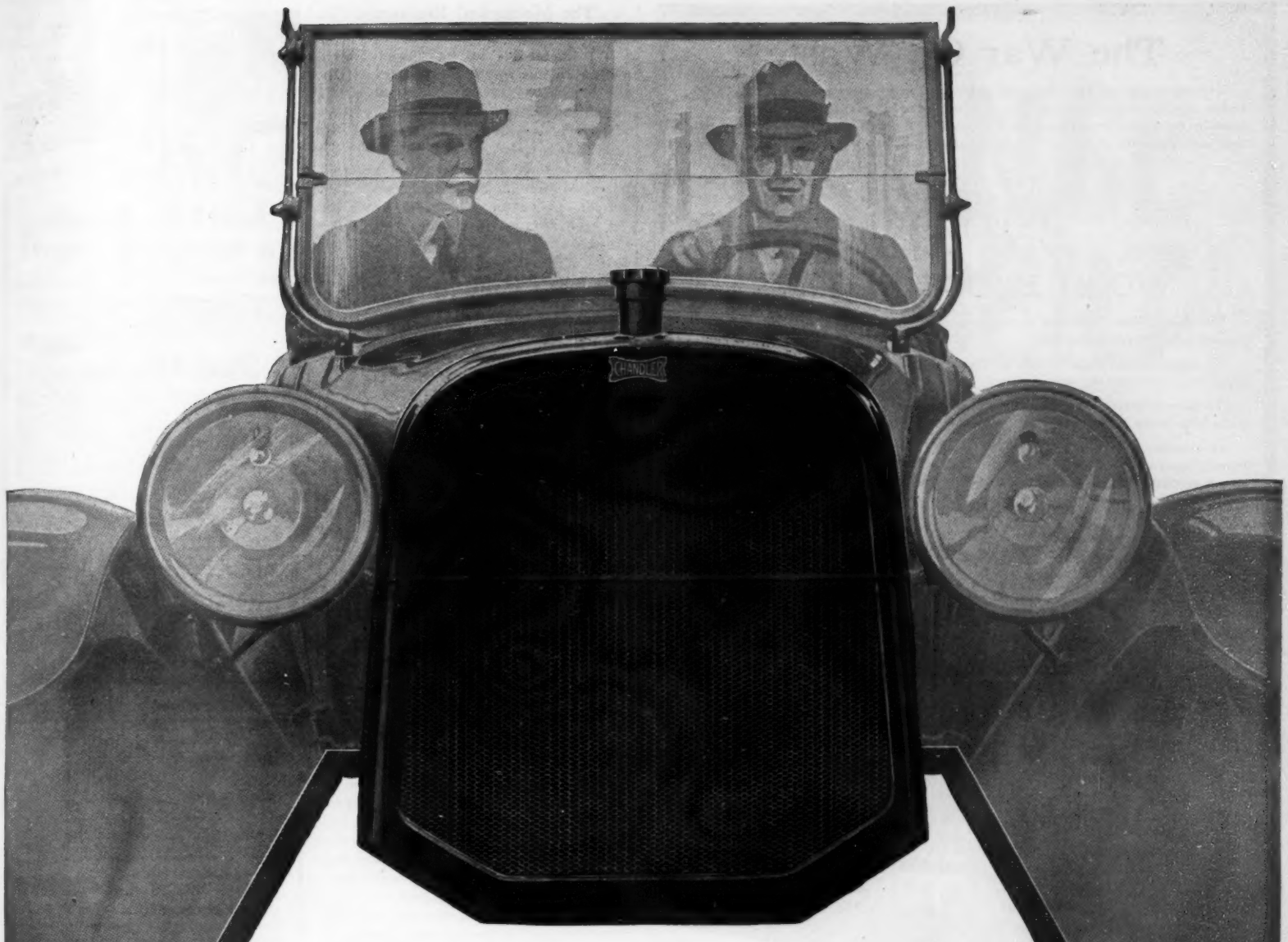
The conclusion is that the gain in weight was principally due to hydrates having been formed during the drying process. Hydrates are soluble products and, remaining in the paint films, may be washed out in the rain. Apparently the old saying was right; it is better not to do painting in wet weather or when the humidity is high.

Hay in High Explosives

THE statement has been made by a representative of the Government that 5,000,000 tons of coarse and grassy hay will be required this year in the production of a filler in the manufacture of high explosives. This hay is thoroughly macerated and 20 per cent of the bulk of the explosive is said to be made of the resultant fiber, replacing the cotton formerly used. There are many places where such coarse, mixed hay can be grown, but where hay suitable for feed is difficult to produce.

Ice-Saving in a Hotel

WHEN it became known that natural ice was needed for the coming summer a hotel in West Virginia cut 300 tons of ice from the lake on its golf links and has a supply which will make it possible to use natural ice for every purpose except table service, the artificial product being made for the latter purpose. This hotel has also kept accurate account of its savings per capita monthly on wheat and meat since last September, and recently a chart was compiled showing these savings, which aggregate four pounds of wheat, four pounds of meat, and six pounds of sugar per capita monthly for both guests and employees.



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The Mechanical Restaurant

(Concluded from page 385)

washed and ready for the second detachment. In this way it is possible for 1,700 people to be served with only 1,300 sets of dishes and eating tools.

Each conveyor serves from thirty to forty people per minute, and since there are four of them, from 120 to 160 meals can be served each minute throughout the noon period. Opportunity has accordingly not yet been afforded for testing the new arrangement to its maximum capacity. In 1916, under the old system, 150 restaurant employees were required to serve approximately 950 meals. In 1917 the lunch-room staff had been reduced to 66, employed in the kitchen and in keeping the steam tables filled with the several dishes; and despite this economy 1,700 meals are served better and more quickly.

Electric motor driven devices are used to do all the mechanical work such as cutting bread, peeling potatoes and other vegetables, chopping meat, mixing dough, beating eggs, etc. Only such items as require for their performance human hands and human intelligence are left to manpower.

The Present Standing of Foreign Trade

(Concluded from page 384)

needed in this country and which will continue to be needed, perhaps in increasing quantities, until peace is declared. Many of these industries, however, are dependent on this country for various supplies, and in supporting them large quantities of so-called, non-essential articles will have to be shipped down. Manifestly, the trade relations of the United States with the South American continent will grow extensively.

England's experience, under even a more drastic system of commerce control than that which has been adopted in this country, is being repeated here and on a larger scale. English exporters and manufacturers engaged in foreign trade found that their exports not only persisted but grew under government "restriction." It has been found in England that articles restricted from exportation, either wholly or for a time, have been quickly replaced by other commodities, and Government authorities anticipate the same adjustment of trade here. In this way, contrary to the popular anticipation, the general export trade of the country is not expected to suffer any real loss.

For certain raw materials the United States is wholly dependent at all times on other countries. Among these is rubber especially. This trade is increasing at a great rate; imports for the seven months ending January, 1917, were $80,200,000; for the seven months ending January, 1918, $115,165,000. In the later period 216,300,000 pounds were imported, as compared with 154,800,000 pounds in the earlier period. We may be able largely to dispense with certain imports, such as coffee and sugar, though it is doubtful, but the importing of rubber, nitrates, manganese and many other products is vital to our industrial life and to a proper prosecution of the war.

From another angle, maintenance of our foreign trade is important. A great deal can be done, and in fact is being done, through the proper distribution of merchandise, various raw materials and foodstuffs, in keeping the sentiment and the semi-official attitude of the neutral nations the world over favorably inclined toward the Allied cause, and in making them, at least in effect, this country's economic, if not its military allies. Thus, the War Trade Board, for this very reason, has frequently found it advisable in the past, and will undoubtedly continue to find it necessary as long as the war lasts, to permit the export of certain supplies in fairly large quantities to neutral nations in order to prevent these nations from falling under the economic influence of the enemy, even though the materials shipped to them were sorely needed by this country and its military allies. With a great deal of business of this sort, which in all probability will increase as time goes on, it seems to be quite generally thought that this country's

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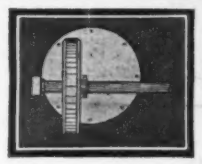

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total volume of exported products is not likely to diminish.

In this connection it has only recently been announced from Washington that export licenses for the shipment of four cargoes of cotton to Spain were granted by the War Trade Board, in pursuance of the recent commercial agreement between the American and Spanish governments. "This action," an announcement by the Board said, "will provide the cotton necessary to fulfill the normal requirements of the Spanish mills and should relieve any fears that have existed in Spain as to the possibility of a cotton shortage."

In other ways the Government is assisting foreign trade and preparing to its utmost ability for future competition. The passage of the Webb Bill, permitting combinations of trade organizations to promote foreign trade, is an important instance of this policy. Some associations have already been formed to take advantage of the new law and it is expected to promote the development of foreign trade materially, especially in South American countries, where its benefit should be immediate.

The Government has also provided the legislation needed to assist in financing foreign trade transactions.

National banks having capital and surplus of $1,000,000 are authorized by the Federal Reserve Act to establish foreign branches and there are today many branches of American banks operating in Latin America, as well as in European countries. These branches have been established, as a rule, by very large institutions, but in order to give all national banks an opportunity of sharing in the benefits of the development of foreign trade, the law provides that any national bank may subscribe an amount not exceeding 10 per cent of its capital to stock of banks organized to transact a foreign banking business. In this way several banks have been established, which are owned in whole or in part by groups of national banks and one of them has at this time 48 national banks as stockholders, who have thus combined to facilitate foreign trade.

It is to be expected that there will be delays and hindrances from time to time in foreign trade transactions. Undoubtedly these difficulties will frequently prove very trying. The tonnage available for the trade fluctuates from week to week. There may be periods when practically no ships will be obtainable, owing to the Government requiring all the bottoms available for purposes more directly concerned with the prosecution of the war from a military standpoint. These passing difficulties and hindrances, however annoying though they may be at the time, will be wholly of a temporary nature, and in their effect will really militate to the ultimate advantage of the legitimate and responsible exporters and exporting manufacturers. They will tend rather to keep out of the trade commercial adventurers than to cause any great falling off in the total yearly volume, especially of the South American exports.

British Patent Bill

(Concluded from page 386)

which compel the manufacture under a patent within a prescribed time. When British lawyers drew the patent bill which is now before Parliament, they modified the Canadian provision which makes it possible to have a patent endorsed as subject to the grant of licenses and which provision was enacted by Canada after a study, not only of her own patent laws but the patent laws of the other principal countries. However, the British bill is a great improvement over the Canadian law for it permits any patent to be endorsed as subject to the grant of licenses, while under the Canadian law only those patents may be endorsed as subject to the license provisions which are granted on subject matter which in the ordinary course of trade would be manufactured to order and would not be offered for sale after manufacture. In the British bill, as in the Canadian law, provision is made for determining the amount of royalties under licenses granted, and there are other and more severe provisions in the bill which patentees must comply with when their patents are not endorsed subject to the license provisions. As an additional inducement to have British patents endorsed subject to the license provisions, the bill provides that the renewal fees on endorsed patents are to be one moiety only on the fees of unendorsed patents. It is also possible to have the endorsements cancelled if there are no existing licenses and the patentee pays the unpaid moiety of all renewal fees.

Under the patent act in Great Britain, when a claim in a patent is invalid, the patent as a whole is invalid until the patent is amended. The bill alters this provision, for under the amendment a court may grant relief in an infringement suit in respect of any valid claim in a patent which is infringed without regard to any other claim in the patent which may be invalid.

The bill also provides for the lengthening of the British patent term from fourteen to fifteen years. It embraces provisions which permit the prolongation of a patent even if it has expired should the omission to prolong the patent in due time be attributable to circumstances connected with the war, and it permits the entering of opposition to the grant of a patent on the ground that the invention has been published in a patent other than a British patent or in any other document prior to the date of the application opposed.

Bread Making in France

IN a paper recently presented to the Societé de Biologie, M. R. Dubois treats of the question of war bread, as now prepared in France, and states that the bakers are using an undue amount of salt in the bread, and this has various drawbacks. Its action is prejudicial to persons whose kidneys are not in good order, and it has the effect of increasing the disassimilation, which increase must be compensated for by an increased absorption of food. Salt also tends to increase not only the general amount of food consumed, but also the amount of liquids absorbed, and this in a considerable degree. For these reasons he counsels the use of bread without salt, at least during the war. He finds by experiment that many persons prefer saltless bread, for the taste of other eatables is thus better appreciated. The question seems to be one of habit, in fact. He even observed a diminution of numerous affections which have no other cause than an over salty diet. Turning to the question of the present standard bread, he finds out by inquiry among the bakers that the bread making process involving the use of lime water is not without drawbacks, and it is stated that lime water "kills the yeast" and the dough will not rise. According to the author, a much better bread would be obtained by using instead of lime water, from 15 to 20 grammes of washed chalk per kilogramme of bread. The paste is whiter and raises perfectly well, and is never acid. It even acquires a very appetizing odor. In short, M. Dubois proposes to replace salted bread prepared with lime water by saltless bread obtained by the use of carbonate of lime. It remains to try the effect of such bread on a large scale in order to see what advantages it presents.

New Zealand Shells Suitable for Buttons

ACCORDING to information which has been furnished by the department of internal affairs at Wellington, the *Trochus niloticus*, commonly found in Queensland and the South Sea Islands, does not occur in New Zealand; but other shells which are found in these waters might be used in the manufacture of buttons, especially the paua, *Haliotis iris*, and the toitoi, *Astraea sulcata*. They are not at present used for the manufacture of buttons or for similar uses, but both occur in great numbers on rocky coasts near the low-tide mark, the paua being much the commoner.

Since these shells have never been sought for commercial purposes, there is no way of ascertaining their cost, the method of disposing of production, markets, etc., but it is understood that they are very easily gathered as the tide ebbs and flows on the sandy beaches about the islands.

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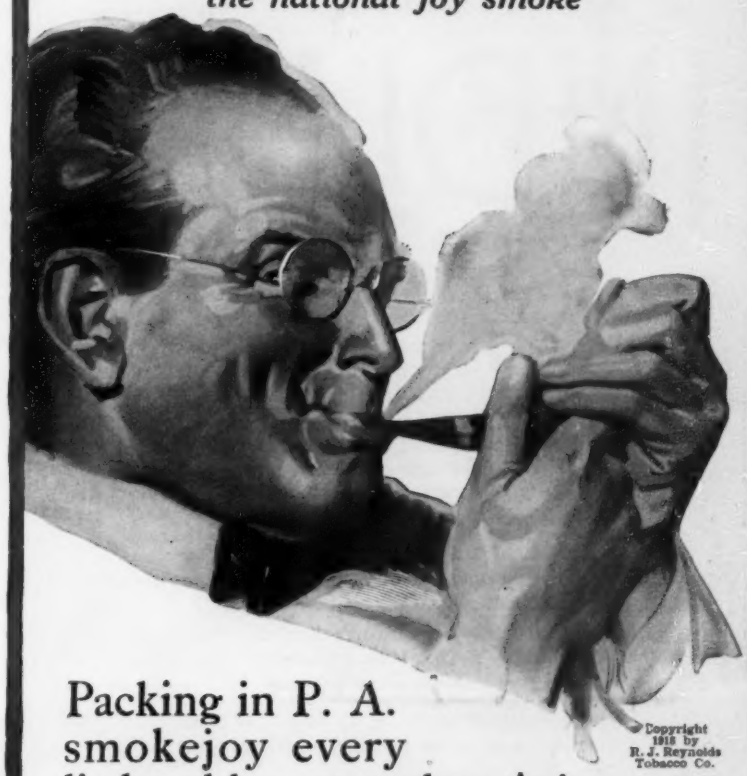

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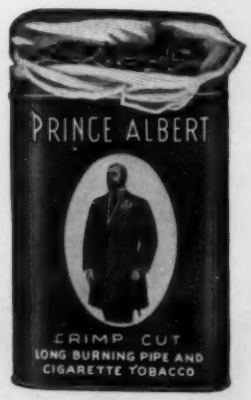

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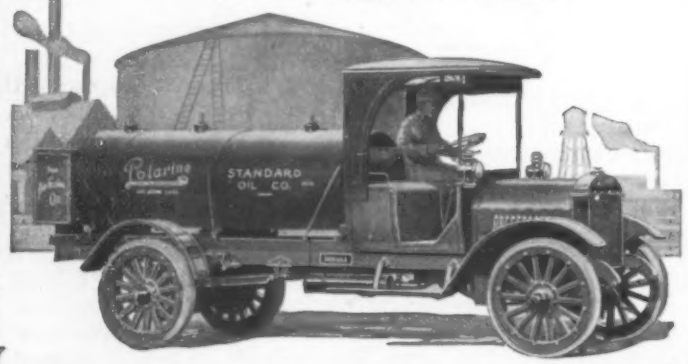

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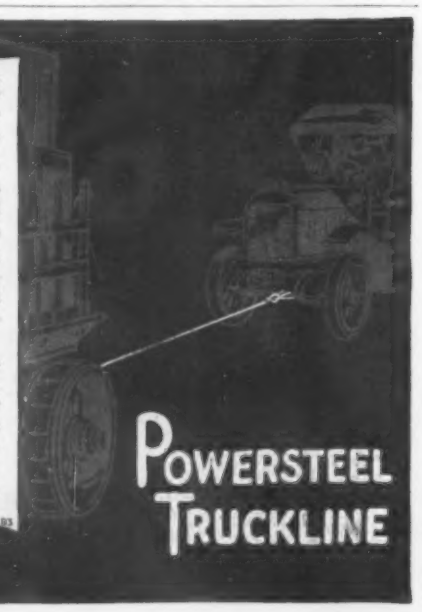

Tea-Chest Manufacture in India

THE total number of tea chests required for the Indian tea crop is between 3,000,000 and 4,000,000. Of this number not more than 1,500,000 chests were, before the war, manufactured in the country. Patent chests are imported from Russia or Japan and the metal fittings required from England or America. Ordinary boxes are imported from Japan in large quantities. Hoop iron, nails, and clips for fastening the patent chests also come from abroad.

It is now proposed to develop the manufacture of tea chests in India, and with this end in view factories using "three-ply" machinery will in all probability be established. The Indian Munitions Board handbook states in regard to this:

"Apart from the machinery used, which is almost entirely imported, the tea industry depends very largely on imported stores. The chief reason for this as regards chests was that exporters greatly preferred the patent chests, either of three-ply wood (as the Venesta and Acme chests) or of metal (as the Metallite chests), because these chests weighed less, were more easily closed, and would hold more tea. With high freights the advantage of a light box is obvious. The big Russian buyers, in fact, would not export except in patent chests and were in the habit of repacking in these in Calcutta. High railway freights also were against the Indian sawmills competing successfully with Japan and other countries in the supply of ordinary wood chests, and except in Assam, where local boxes were largely used, the possibilities of Indian supply had hardly been examined.

"The timber required for tea chests is of a very special kind. It must contain no sap that would corrode the tea lead in which the tea is packed; must be free from any odor, as tea will take thus up readily; and must be well seasoned, as the tea is usually hot when packed, and unseasoned wood will warp. Examination of the question has shown, however, that suitable timber exists in India in large quantities, and that it is only necessary to put the producer and consumer in touch with each other to secure its acceptance. In addition the demand for patent tea chests will inevitably drive this country to establish three-ply factories for the manufacture of these. Messrs. Bird & Co. are already establishing a three-ply factory in Assam, and the Bengal Government is negotiating with another Calcutta firm for concessions in the forests of northern Bengal with the object of supplying the demand for three-ply tea chests."

Commercial Aviation in Norway

A LARGE number of prominent business men from all parts of Norway have decided to issue a prospectus relative to the organization and promotion of a company for maintaining regular aerial routes, partly between points in Norway, and partly between Norwegian and foreign points. The organizers held a meeting at Christiania on March 1st, 1918, and the prospectus probably will be ready for distribution within a short time.

There is hardly a country in Europe where the distances between important cities, compared with the size of the population, are so great as in Norway. Large parts of the country still have means of communication which are very inadequate, and will be unable to obtain better methods of transportation in the near future, unless it is by aerial passenger and freight routes. The time seems to be ripe for the formation of such companies. Their methods have now been so advanced that wind and weather no longer are serious hindrances.

The project calls for the establishment of routes which are to follow the Norwegian line from Christiania to Christiansand, Stavanger, Bergen, Trondhjem and even as far north as Kirkenes. Other routes are planned for cross-country service between Christiania, Trondhjem, and Bergen. There will be, in addition to these routes, others which will endeavor to maintain regular service between Stavanger and Aberdeen, Scotland, and between Christiania, Norway, and Copenhagen, Denmark, by way of Goteborg, Sweden.

Hydroplanes of the latest models will be used, and it will be the endeavor of the company to make them as capacious and comfortable as possible.

A timetable has been worked out with care. According to the proposed table, it will require 4½ hours to cross from Stavanger, Norway, to Aberdeen, Scotland, and to go from Christiania, Norway, to Copenhagen, Denmark. The distance from Christiania to Stavanger, following the coast, will be covered in 4¼ hours; from Stavanger to Bergen, 1½ hours; and from Bergen to Trondhjem, 5 hours. It will also take 5 hours to go from Christiania to Trondhjem, overland, while the trip from Bergen to Christiania, overland, will take only 2¾ hours. The time for covering the distance between Trondhjem and Kirkenes has been placed at 11 hours. Under present conditions it takes days and sometimes even weeks to travel this same distance. If the new plan becomes a reality, it will be possible to leave Christiania at 7 P. M., and to arrive at Kirkenes at midnight of the same day.

After-the-War Plans of Austrian Machine Works

AN Austrian Social Democrat organ has published a rather long article which treats of the activity and organization of the Skoda Works, located at Pilsen, Bohemia. Although this enterprise is still working as always on an elaborate scale for the production of war materials, it is already making comprehensive preparation for "peace" work. A special division of engineers and merchant directors has been formed, whose purpose is to work out a detailed plan for the transition of the whole enterprise to "peace" activities.

The production of war material will not be given up entirely, but a great part of the plant is to be turned over to "civil" production. One division is to be transformed into a gigantic machine factory, in which machines are to be produced for export, especially farming implements. Machinery export, especially to Russia and the Balkans, is being counted upon. The plants connected with the Skoda Works already have on hand great supplies of machines which are to go to Russia just as soon as the border is opened.

The Skoda Works are counting upon the neutralization of the Dardanelles and the resulting great augmentation of traffic on the Danube, and a part of the Pilsen plant is to be devoted to the production of motor boats for export to Turkey and Bulgaria. The Skoda Works also plan to undertake shipbuilding, for which purpose they have joined with the Montan Co. and the "Firma Starck," for whose collieries they are now making machines.

Finally, the Skoda Works will transform a part of their present gun works into a plant for automobiles and flying machines.

New Soap and Glycerin Plants in India

THE director of industries and commerce of Hyderabad recently visited Malabar. It is understood that his Government contemplates shortly opening a soap factory at Hyderabad, and that the director's visit was for the purpose of collecting information and copying the Government soapery in Malabar as regards plant, etc. The official mentioned, accompanied by the Government oil chemist, also visited Messrs. Dutt's oil mill and the Government cannery at Beypore. It is believed that the Bombay Government will soon establish a soapery, and indeed it is evident that the several Provincial Governments are inquiring into the possibilities of the soap business, which Sir F. A. Nicholson has so successfully demonstrated as a sound commercial proposition. More than all this, it is quite probable that the minutions board, before very long, will be running large factories at various centers in India for the manufacture of glycerin, one of the chief constituents of explosives. A glycerin industry is well calculated to bring in its wake factories for the manufacture of soaps and candles, and altogether the outlook for the oil trade is certainly promising. The West Coast, it may be mentioned, is eminently suited to the manufacture of glycerin, since oils of all descriptions are very largely available.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14278) H. E. N. asks: It is a law of physics that simple machines such as levers do not create more power but merely emphasize one member of the work equation, power and distance, equals work. But in pushing a wagon, a certain power of say, 500 pounds against the frame will move the wagon. Say that it is pushed three feet in this manner. But when 250 pounds is applied to the end of a spoke of a wheel, the hub and spokes act as a bent lever. The spoke in the fellow on the ground acts as fulcrum, the axle as the weight, and the power is applied at the end of another spoke, the whole acting as a bent lever. This lever has a mechanical advantage of two, and thus 250 pounds on a spoke will move the wagon where 500 pounds was required on the frame and axles directly. Will you please explain how in this case a mechanical advantage of two is obtained while there is no loss of distance as turning the spoke through an arc of a yard is equivalent to moving the wagon on a yard directly. A. The problem of moving a wagon by force applied in various ways is an interesting one. When 500 pounds are required to move the wagon if aplied directly to the body in a horizontal direction, a force of half that amount, or 250 pounds will be required if applied in the direction of the rim of the wheel near the top because the rim transmits the force to the top of the wheel. The fulcrum is at the bottom of the wheel on the earth, the weight is at the center of the axle, and the power is applied at the top of the wheel or with an arm of two times the weight arm. If the force is applied directly to the body of the wagon, the fulcrum is on the earth, the weight is at the center of the axle and the power is applied at the center of the axle, and therefore, the power and the weight arms are equal. In this case, as you say, 500 pounds moves the wagon, while half as much, or 250 pounds moves the wagon when the power is applied to the rim of the wheel and in the direction of the rim. The top of a wheel moves forward twice as fast as the center of the axle moves, while the point of contact with the ground is at rest for an instant, as a fulcrum. There are several other cases, giving other results.

(14279) W. C. M. asks:—1. Astronomers tell us the sun is a yellow star. How, then, can it give white light? How comes it that this yellow star's light can be broken up into seven elementary colors, only one of which is yellow? 2. The three primary colors of the spectrum and rainbow are red, blue and yellow, each of standard tint. The red and blue make violet; the red and yellow, orange; the blue and yellow, green. Where, then, comes the indigo? It is blue plus—what? Whence is it derived? Is it certain that the spectrum contains indigo? If so, then there must be more than the *three* primary colors. 3. What are the proper colors for the flag—standard red, pink, carmin, scarlet, crimson, turkey red? Standard blue, baby blue, ultra marine blue, plumb blue, navy blue, indigo blue or what? About all these tints and shades can be found in different flags. 4 Is it true that Polaris is always on the meridian when a plumbline let fall will pass through it and Mizar? I got that when I was a boy. There must necessarily be some correspondence between Polaris and The Dipper, or between the Pole and the Dipper, whereby the Pole can be determined without taking the oscillations of Polaris. A. 1. To say that a star is yellow means that that color is so strong in its light as to impress the eye with its tinge. All the other colors of the spectrum may be present as well. It does not mean that the light is monochromatic or of a single wave length. There are no stars which give monochromatic light. All stars, the sun included, radiate all the colors of the spectrum of what we call white light, but many stars have a predominance of red, yellow, blue, or of some other color. 2. The solar spectrum has all the wave lengths from the lowest red up to the extreme violet which can affect the eye and excite vision, and in addition it has a wide range of wave lengths which cannot affect the eye at all, the infra-red and the ultra-violet. What we can see is far less than what we cannot see. To the luminous portion of the solar radiation Sir Isaac Newton gave about two hundred years ago the seven names which you use and they have persisted to this time in common speech. There is little of value in them today. There are many other tints which might be named if we had names for them, and any tint in the spectrum is as really a primary as any other tint. Indigo is not blue plus anything. It is light of a certain wave length in the spectrum, so too of any other tint. Orange is not red plus yellow. It is a certain wave length and would be there in its own place if there were no red or yellow adjacent to it on either side. No scientist would say that red, yellow and blue are the only primary colors. Any tint in the spectrum is as primary as any other. Nor is it true that yellow and blue make green. They do in paints but not in lights. Yellow and blue light when mixed make white light For these matters see any thorough text book of light. 3. The proper colors for the American Flag are those of the standard wool bunting, which is to be had from the manufacturers. As you say all sorts of shades are to be seen but flags which vary much in tint will be found to be made with cheaper materials and dyes, and even wholly of cotton. Such materials do not yield the same results under the same dyes as the wool bunting. 4. A good approximation to the meridian is had by means of a plumb line and the stars Polaris and Mizar. On December 20th, they are on the plumb line at about 7 P. M. and on January 20th at about 5 P. M. One who would locate a north and south line by this method should begin to watch the stars with reference to the plumb line at these hours. You will find the method in Todd's New Astronomy beginning on Page 115. We will send the book for $1.45 postpaid. It is sufficiently accurate for the surveyor but is not as accurate as those employed by the astronomer. Polaris and Mizar are almost on opposite sides of the true North Pole. Hence when one is directly above the Pole the other is below the Pole. The right ascension of Polaris is about one hour, thirty-one minutes and that of Mizar is about thirteen hours, twenty-one minutes. The difference from 12 hours is so small that an ordinary surveyor need not concern himself with it.

(14280) S. B. asks:—Please send us a formula for refinishing mirrors with mercury A. To coat a mirror with mercury amalgam, a flat stone table is employed, with a ledge around the edge so that the mercury shall not run off and be lost. Upon the table pure tin foil is spread, and pure mercury is poured upon the tin foil. The amalgam is thus formed. There will be some, but should not be much excess of mercury. The glass to be coated must be chemically clean. It is placed edgewise upon the table and lowered upon the amalgam, thus pushing out the air as it is lowered. The mercury is pushed out before the glass as it is turned down. Place a pad upon the glass and a board over the pad. Upon the board place weights so as to force out any excess of mercury remaining, and keep the amalgam in contact with the glass. The amalgam hardens in a day or so, and the glass may be lifted taking the amalgam with it. Full particulars for cleaning the glass and coating it in various ways are to be found in our Cyclopedia of Formulas, price $5 by mail postpaid We are sending you a circular giving the scope of this valuable work.

(14281) C. F. R. asks: Can you tell me if it is possible, anywhere in the ocean, for a sinking ship to be suspended before it reaches the bottom, by the increased density of the water. Leaving out of consideration any air that might be trapped, is the ocean anywhere deep enough for this to happen? Or, supposing a certain amount of air were trapped, not enough to float it at the surface, would this support it on a lower level, or would the water compress the air sufficiently for it to continue sinking. A. We are just now receiving many inquiries about this matter. The compressibility of water has been most thoroughly investigated for various pressures from one atmosphere to 3,000 atmospheres, and for various temperatures from zero to boiling. Three thousand atmospheres correspond to a depth of about 20 miles and the temperature at the bottom of the ocean everywhere is not much above freezing. At this temperature and pressure the compressibility of water is .0000261, which is not far from one forty-thousandth. At a liberal estimate water at the bottom of the deepest known places is not more than 5 per cent denser than at the surface. Anything whose density is more than 1.05 will sink in water of the greatest density possible in the ocean. The enormous pressure at great depths would break in any vessel which contained air and allow the air to escape thus rendering the vessel heavier, or less buoyant. Trapped air would have little influence at any considerable depth. Of course the greatest known depth of ocean is six miles and not twenty. At that depth the compressibility of water is somewhat greater but this hardly alters the result. It could not affect the sinking of an iron vessel.

(14282) J. D. asks: I am unable to see wherein the ordinary definition of gravitation, as far as it gives the strength of that force is strictly scientific. It seems to me it is defined in terms of itself. This definition, I believe, states that this attraction which matter has for matter is proportional to the mass of matter. I know mass is not the same as weight but that it is proportional to weight, which is measured by gravity or gravitation. Also, has there ever been any investigation tending to show that gravitation may be the same force as cohesion or adhesion of matter? For example, a small bar of iron has a tensile strength of a thousand pounds represented by its cohesive force. If we suppose that the atoms of iron are, say, within one-millionth of an inch apart and that when two pieces of iron are made to touch each other the great majority of the atoms must be many times that distance from the atoms of the other piece, would not the law of inverse squares reduce that force so much that it would sensibly disappear? A. The gravitating force between two bodies is directly proportional to the product of the two masses and inversley proportional to the square of the distances between their centers of gravity. This is a statement of the strength of the force and does not define the force itself. No definition of the nature of gravitation, which has met universal acceptance has been made. The forces of cohesion and adhesion only act upon actual contact, while gravitation acts at all distances. They are reduced to zero at infinitessimal distances, while gravitation would become very much stronger at infinitessimal distances.

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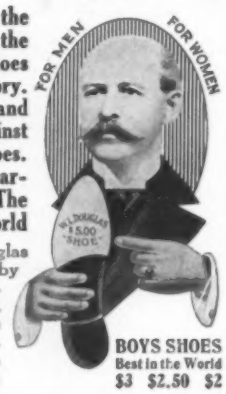

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NEW BOOKS, ETC.

LAW FOR THE SOLDIER. A Legal Advisor for Men of the Service. By Leslie Childs, 2d Lieut., 335th Infantry, N. A. Menasha, Wis.: George Banta Publishing Co., 1917.

This little pocketful of military law condenses within its small compass some of the most important things the soldier ought to know. Offenses and the penalties incurred by the offender are tabulated at considerable length, and there are citations from the Army Regulations and the Articles of War covering numerous points, from eligibility for enlistment and the rank and precedence of officers to pay, allotments and deposits, rations, honors and battle reports.

MATHEMATICS FOR COLLEGIATE STUDENTS OF AGRICULTURE AND GENERAL SCIENCE. By Alfred Monroe Kenyon and William Vernon Lovitt. New York: The Macmillan Company, 1917. 12mo.; 364 pp.; illustrated. Price, $2.

For students specializing in agriculture, biology, chemistry or physics, this work is well adapted to the purposes of a text in freshman mathematics. Its commendable aim is to arouse and sustain the interest by a selection and treatment that shall show the close relationship of the topics to everyday life in college and out; and since the course will undoubtedly constitute in many cases the entire mathematical equipment, it has been deemed wise to include chapters on such subjects as annuities, averages and correlation, which are not usually brought before students of this grade. The numerous exercises, based upon agricultural and other experiments, stimulate clear thinking toward practical ends; the course as laid out will account for three hours a week for one year, but by the omission of certain chapters this may be shortened to a half-year course.

THE LIGHTING ART. Its Practice and Possibilities. By M. Luckiesh, Physicist, Nela Research Laboratory. New York: McGraw-Hill Book Company, 1917. 8vo.; 239 pp.; illustrated. Price, $2.50.

Illumination really constitutes a new science and art, and even to those who can think back to the days of candles the change it has worked in the aspect of civilization is not appreciated at its full value. Books that discuss lighting from an engineering viewpoint are not wanting; the writer believes that a broader discussion which follows the problems into the related sciences and arts will aid in cultivating creative ability and will produce results "more worthy of the potentiality of light." The chapter on the expressive possibilities of light suggests to the architectural lighting specialist a new order of things in which light may take its place by the side of decoration as a not inferior art; as in painting, "visualization" plays a great part in successful light effects and may be in its higher achievements a manifestation of genius; but the work does not confine itself to esthetic considerations; commercial and industrial lighting receive due attention, and basic principles are emphasized. Artistry and practicality are balanced and merged and make the volume a valuable and unique contribution to the literature of illumination.

A SHORT HISTORY OF SCIENCE. By W. T. Sedgwick and H. W. Tyler. New York: The Macmillan Company, 1917. 8vo.; 490 pp.; illustrated. Price, $2.50.

Sarton said, "The history of science should be the leading thread in the history of civilization." It is encouraging to see that this thread, so long neglected, is beginning to be woven into the texture of our school books. An excellent treatise, whether for school use or for general reading, is here provided by the Professor of Biology and the Professor of Mathematics at the Massachusetts Institute of Technology, in which is set forth, not too technically, a review of the scientific ideas and discoveries that are milestones along the road from the distant past to the living present. The work bears evidences of the greatest care in arrangement and treatment; it begins with the earlier civilizations, the mathematical science of Babylonia and Egypt, and the birth of science in Greece; the Roman world, the Dark Ages, the work of Hindu, Arabian and Moorish thinkers, and the progress made up to 1450 A. D., bring us to the new astronomy and the birth of modern natural science; the course of mathematics and mechanics is followed through the sixteenth century, and tendencies, modifications, theories and discoveries are traced down to the civilization of today, while valuable appendices deal with individual investigators and with inventions.

GUIDEBOOK FOR THE IDENTIFICATION OF WOODS USED FOR TIES AND TIMBERS. By Arthur Koehler, Expert in Wood Identification, Forest Products Laboratory, Madison, Wis. Washington, D. C. Government Printing Office, 1917. 8vo.; 78 pp.; 31 pages of plates.

The author is well qualified to write such a treatise as this, for he is the official expert in wood identification in the U. S. Forest Products Laboratory. The book points out the differences which are of practical value in the identification of native woods used for ties and timbers. It contains two analytical keys, one based on characters visible to the unaided eye and another based on characters visible only by means of a hand lens. Great pains and no little ability have been used in presenting these keys. While the book is intended primarily for tie inspectors it will, it is believed, be of great value also to others, because it contains valuable scientific data which none but a student of technique and plant anatomy could have collected, collated and recorded. The subject has been studied for many years by painstaking scientists and now there is a popular demand for a less technical discussion; Koehler

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has performed this task with ability and industry. Those who have studied the structure of woods are acquainted with the paucity of reliable characteristic differences and the consequent difficulties attending identification of the woods. The present work, however, is an admirable endeavor, and is executed as well as the nature of the subject permits. The appendix contains reproductions of 60 species of woods, from which inspectors and others can derive much assistance.

BRITANNICA WORLD'S WARS MAPS. New York: The Encyclopaedia Britannica Corporation, 1918. Price, per set of three maps, plain paper, folded, $2; mounted on linen, $5.25; mounted on linen, with brass tops and bottoms, for hanging on wall, $7.25.

With these three admirably executed maps the user may trace the course not only of the present war, but also of the great world wars that have preceded this one. The maps carry much historical matter, inserts, and comparative statistics, and are the greatest possible aid to an intelligent appreciation of what is actually taking place. As an example, on Map No. 1 is seen a dotted red line marking the farthest German advance toward Paris; the present fighting line is equally well indicated, so that the distance the enemy has been driven back is instantly seen and appreciated; American eyes will turn with intense interest to the Rhine-Rhone canal, where the boundaries of Alsace, France and Switzerland meet, for it is here that our troops had their first clash with the enemy; at the top of the map is an insert showing the land area of the world as divided among the Allied, Teutonic and neutral powers; we are also given comparative statistics of population, national wealth, commerce, cereals, and iron and steel production. The side margins are devoted to historical notes which show how this ancient battleground has been fought over for ages, and since the map is divided into numbered squares, the location of any place referred to is readily found. Map No. 2 covers Eastern Europe and the Eastern front; Map No. 3, Southeastern Europe, Turkey in Asia, and the Italian, Roumanian, Salonican, Mesopotamian and Palestinian fronts.

EVERYMAN'S CHEMISTRY. The Chemist's Point of View and His Recent Work Told for the Layman. By Ellwood Hendrick. New York and London: Harper & Brothers, 1917. 8vo.; 374 pp. Price, $2 net.

Even the man who reads newspapers and nothing else, now knows that chemists and chemistry have come into their own; the application of modern chemical knowledge has subtly changed the face of our civilization, while in this world war an understanding of molecules has proved to be more important than men or machine guns, and may well determine the final result. Mr. Hendrick, addressing himself to those who "don't know anything about it," manages not only to impart to the layman a really clear and fairly comprehensive understanding of chemistry as it touches industry and everyday life, but contrives also to amuse him at the same time. It tells not so much how the chemist works as how he thinks, and represents him not as a superman, but as a business man systematically attacking what are often, in the last analysis, business problems.

THE STORY OF PRINCETON. By Edwin M. Norris. Boston: Little, Brown and Company, 1917. 12mo.; 270 pp.; illustrated. Price, $2 net.

The newest volume in this series comprising the stories of our colleges deals with "Old Nassau," and its author is well-known to every Princeton man as the editor of the Princeton Alumni Weekly. The essential history of the University from its founding in 1746 down through the administration of the successive presidents, including the administration of Woodrow Wilson, is comprehensively and entertainingly recorded; best of all, Mr. Norris chronicles and preserves for us some of the more characteristic anecdotes and traditions that through two centuries have gathered about the name of Princeton. He also sketches deftly the distinctive features of its undergraduate life, such as the upper class club houses. Mr. Hornby's excellent drawings of the famous college buildings add materially to the appeal of the book, which promises to be as great a favorite with Princeton men as "The Story of Harvard," "The Story of Dartmouth," and "The Story of Wellesley" are with the graduates and undergraduates of those centers of learning.

THE WAR AND THE BAGDAD RAILWAY. By Morris Jastrow, Jr., Ph.D., LL.D. Philadelphia and London: J. B. Lippincott Company, 1917. 8vo.; 160 pp.; 14 illustrations and map. Price, $1.50 net.

In telling the story of Asia Minor and its relation to the present conflict the author covers a neglected but important issue. Turkish concessions to Germany aggravated a complicated situation and largely contributed to the probability of war; and exploitation will still remain as a trouble-maker after war is ended unless coöperation with the East takes the place of this insidious method of extending national spheres of influence. Internationalization of all such schemes is the author's solution of the Eastern Question. The physiography and history of Asia Minor is set before the reader in a thorough yet entertaining way; the Bagdad Railway project is followed from its inception to the present, only 265 miles of rail being required to complete the gigantic enterprise; and the issue and the outlook take definite contour beneath the skilled pen of the writer in the last chapter. The large folding map provides a means of following the Eastern campaigns of the war.

RIGHTHANDEDNESS AND LEFTHANDEDNESS. With Chapters Treating of the Writing Posture, the Rule of the Road, etc. By George M. Gould, M.D. Philadelphia and London: J. B. Lippincott Company. 8vo.; 210 pp.; illustrated. Price, $1.25 net.

Various theories have been put forward to account for the superior dexterity of the right hand; with most of these Dr. Gould has little sympathy. His long study of this subject leads him to the position that a solution of the mystery can come only from a close investigation of the habits and necessities of ancestral types at the time righthandedness and lefthandedness arose. Animals do not seem to exhibit differentiation; in the babe it is established at the seventh or eighth month. The author advances the interesting theory that righthandedness is the result in many cases of righteyedness. His work develops many phases of the question usually overlooked, and the importance of a better understanding of the matter is indicated in certain facts known to the ophthalmologist and neurologist, in which suffering and even suicide are traceable to morbid visual function often arising from the mistaken discipline of the schools.

AIRCRAFT IN WARFARE. By F. W. Lanchester, M. Inst., C.E., M.Inst. A.E. With Introduction by Maj.-Gen. Sir David Henderson, K.C.B., Director General of Military Aeronautics. New York: D. Appleton & Company, 1916. 8vo.; 242 pp.; illustrated. Price, $4 net.

As the Director General of Military Aeronautics points out in his humorous and informative introduction, there are really no experts in military aeronautics as a whole; there are some few experts in the various branches. Mr. Lanchester, however, has probably as great a mastery of the fundamentals as wide and varied experience added to a scientifically-equipped mind can bestow, and his work raises many interesting questions and puts forward theories and calculations that are worthy of the most careful study. His earlier writings on this subject proved to be prophetic; he foresaw the gun-carrying and bomb-bearing machine, dispossessed the cavalry in favor of the airplane, and declared that the issue of a great battle would be definitely determined by the efficiency of the air forces. His N-square law, dealing with the concentration of force, works out and logically proves a principle long used in sea and land fighting, and is a valuable contribution to military aeronautics. The work is comprehensive in scope, covering many problems of the aeronautical arm in attack and defense, its strategical and tactical uses, its employment of the machine gun, armor and shield protection, navy service, and the rights and obligations of neutrals. All students of the subject will be repaid for a perusal of the work, for its suggestions are based upon known facts.

MACHINE GUN FIRE CONTROL. By Captain Glenn P. Wilhelm, Fourth U. S. Infantry. Cleveland, Ohio: Edward C. McKay, 1917. 8vo.; 84 pp.; illustrated. Price, $1.75; with ballistic computing slide rule, $2.50.

MILOMETER OR BALLISTIC COMPUTING SLIDE RULE. Devised and perfected by Captain Glenn P. Wilhelm, Fourth U. S. Infantry. Cleveland, Ohio: Edward C. McKay. Price, $1.75; with "Machine Gun Fire Control," $2.50.

A thorough knowledge of ballistics is demanded of the machine gunner, and in Capt. Wilhelm's book the principles of this science are skilfully imparted. With the aid of this text and the ingenious slide rule perfected by the author, a gun commander will find mathematical operations greatly simplified; he will develop an ability to meet all conditions and exigencies and to emerge with credit from the most difficult situations. The terms of gunnery are concisely defined and an intelligent grasp of definitions and practice is materially accelerated by diagrams and sketches. The mil system of angular measurements is explained, the subject of indirect fire thoroughly covered, and the use of the ballistic slide rule carefully and clearly set forth. This handy little instrument, of heavy white celluloid, equipped with a catgut cord, mechanically figures out ranges, measures angles, determines widths, calculates sight setting or elevation for all kinds of fire, and determines fire control and map problems, combining the advantages of the various mil scales and computing rules besides offering distinct advantages of its own.

AMERICANIZATION. Compiled and edited by Winthrop Talbot, A.B., M.D., New York: The H. W. Wilson Company, 1917. 8vo.; 372 pp. Price, $1.50 net. Insert 6-Point.

Only in the extension of American ideas and ideals unhampered by racial and geographic limitations may we build a glorious future upon a glorious past. In the excellent bibliography which introduces this volume, Dr. Talbot points the reader to works that will "clarify our national thought in regard to present vital problems, such works as outline the philosophy of nationality, give a definite meaning to Americanism, and exhibit the mechanism of Americanization at home and abroad." The principles of Americanism are set forth in excerpts from historical documents and are further expounded by Dr. Talbot and other thoughtful writers of today; in the same manner the essentials of Americanization are summarized, while the final and longest section of the volume is devoted to the technic of race-assimilation, in which the immigrant problem, education, the library and the foreigner, living conditions, and naturalization are handled in their multiform phases by well-qualified specialists. The sociologist, the educator and the general reader may all derive the greatest assistance from this digest.

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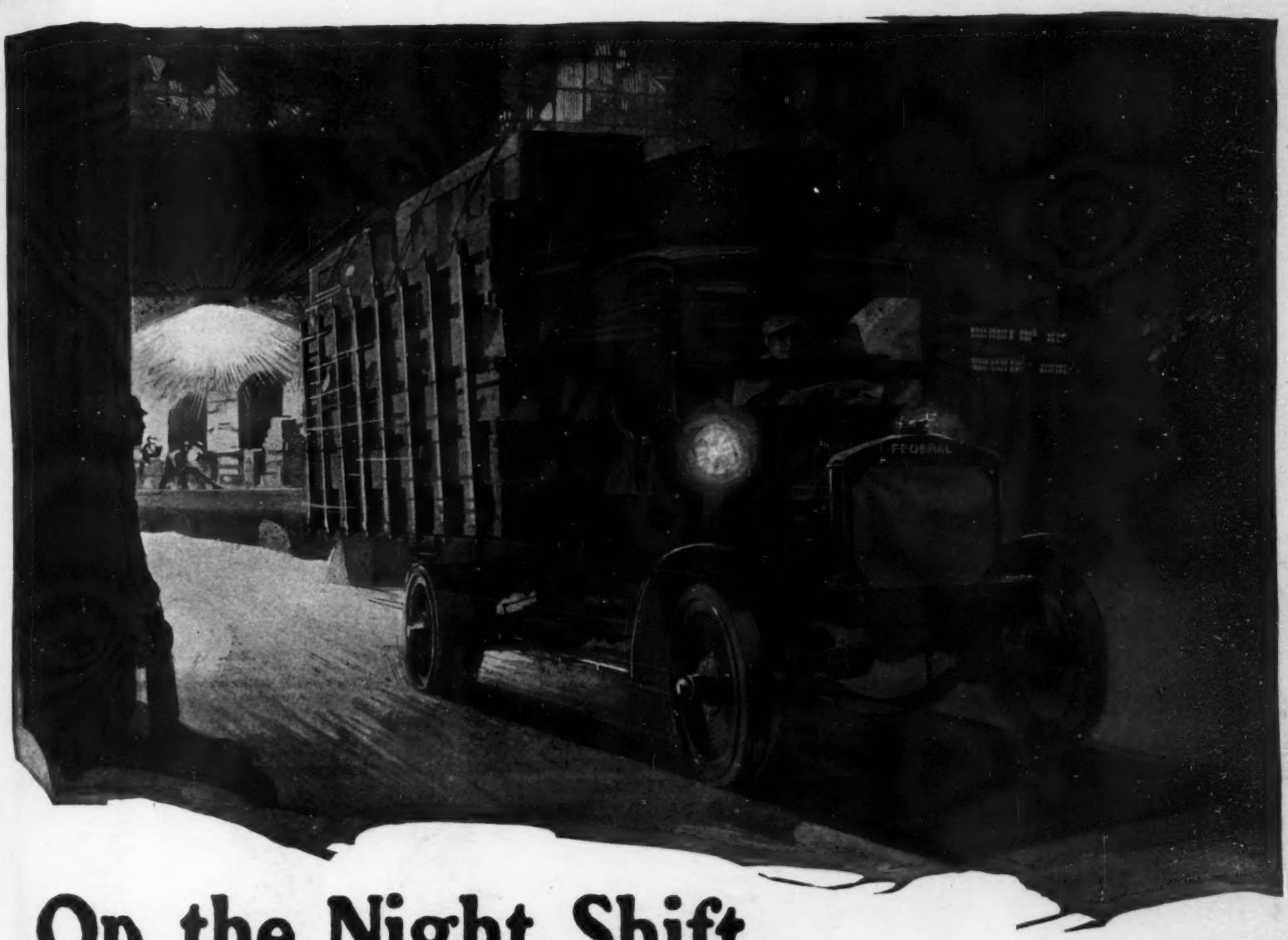

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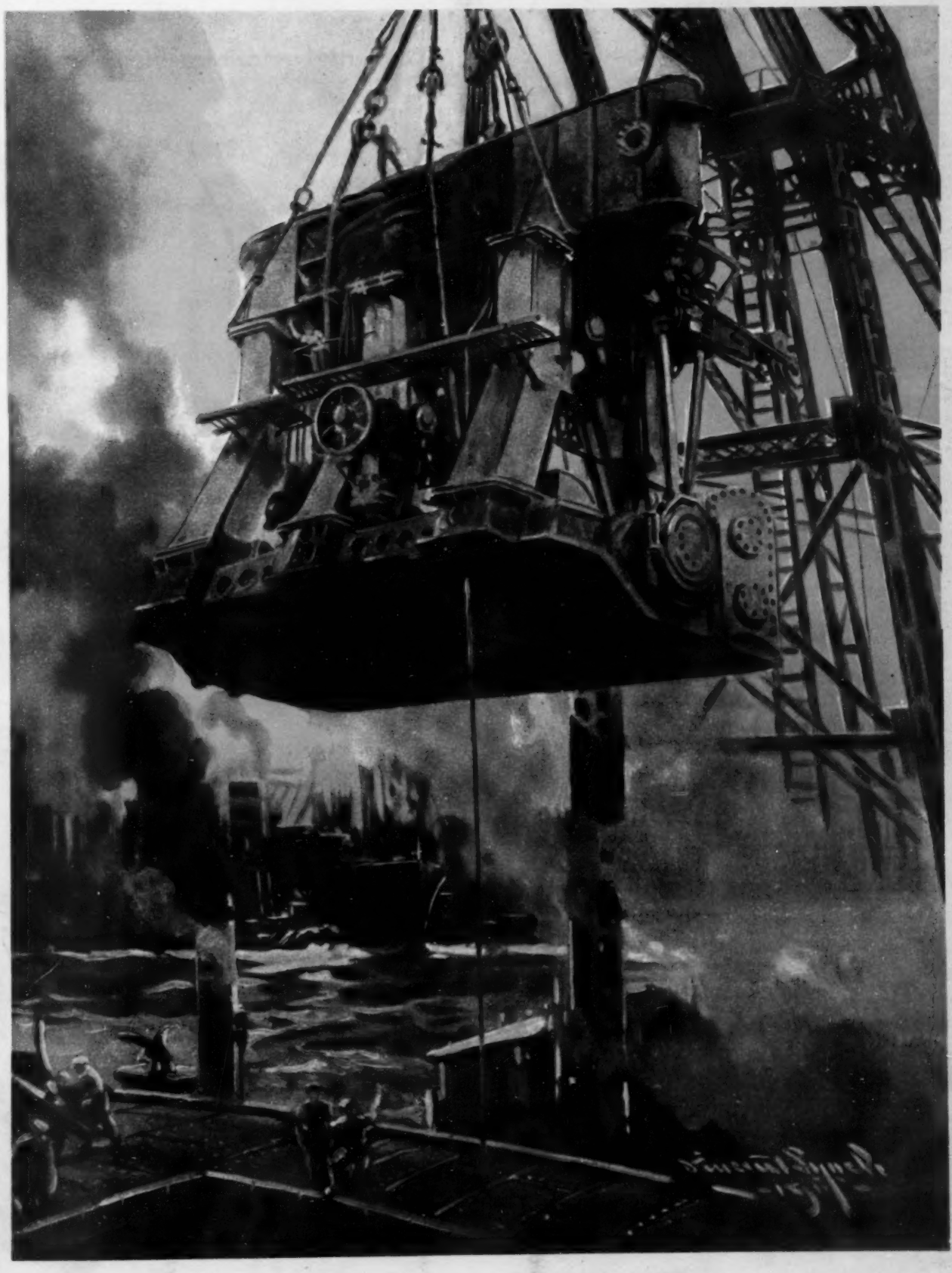

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American Ambulance Field Service	0	0	0	0	0	0	1	22
American Can Company	0	0	4	7	8	8	33	56
American Express Company	0	0	0	7	8	8	44	44
American Petroleum Company	0	0	0	0	0	0	0	12
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Clearing House Parcel Delivery Co.	0	0	0	0	0	3	10	10
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Cleveland-Akron Bag Company	6	7	9	14	15	19	21	39
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Cleve. & Sandusky Brewing Co.	0	0	1	1	2	3	10	15
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Coca-Cola Bottling Companies	0	3	6	12	26	38	75	122
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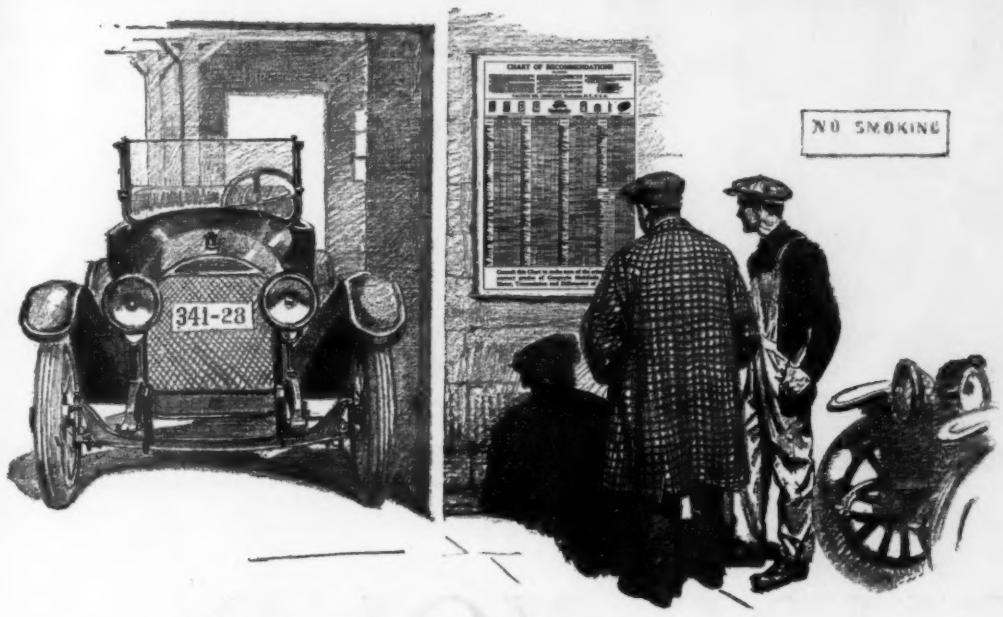
Fly & Hobson Company	0	0	0	0	0	0	0	14
Foster & Kleiser, Inc.	0	2	4	4	8	10	10	10
Harry V. Franks	0	0	0	0	0	0	6	16
Frederick & Nelson, Inc.	0	0	0	3	7	9	10	13
A. W. Gamage, Ltd.	0	0	14	14	14	14	14	14
General Baking Company	0	0	0	1	1	1	1	10
Georgia Railway & Power Co.	0	0	1	3	7	7	18	22
Gilman Motor Trucking Co.	0	0	0	0	0	0	0	10
Gimbel Brothers	0	20	26	46	59	59	62	62
Glacier Park Transportation Co.	0	0	0	0	10	20	22	23
Stacy G. Glauser & Son	0	0	0	0	0	2	4	14
Adolf Gobel	0	0	0	0	0	0	0	10
J. Goldsmith & Sons Company	0	0	3	4	5	5	7	12
B. F. Goodrich Company	4	6	9	11	12	17	19	22
Goodyear Tire & Rubber Company	0	0	0	0	0	0	3	10
Great Northern Paper Company	0	0	0	1	1	11	13	18
Greenfield Elec. Light & Power Co.	0	3	6	9	10	11	13	13
Gulf Refining Company	0	1	9	29	81	172	463	563
Halle Brothers Company	0	0	0	0	0	0	12	13
Haverty Furniture Company	0	0	0	0	2	6	7	12
Hawaii County, T. H.	0	0	2	9	9	9	10	11
H. J. Heinz Company	0	0	0	0	0	0	16	19
The Higbee Company	2	4	5	6	10	10	10	12
Joseph Horne Company	5	12	15	24	33	39	47	47
J. L. Hudson Company	0	0	0	0	0	10	17	20
Imperial Oil Company, Ltd.	0	1	1	1	1	1	12	42
Independent Brewing Co. of Pgh.	1	1	2	5	5	11	28	36
Jones Store Company	0	2	2	5	6	10	14	17
Kaufmann Dept. Stores, Inc.	0	0	10	16	24	44	80	80
Kaufmann & Baer Company	0	0	0	1	40	45	51	59
C. D. Kenny Company	0	0	0	0	0	0	12	36
Henry Knight & Son	0	0	0	0	0	0	0	10
Theodor Kundtz Company	3	7	8	9	10	11	12	13
J. William Lee & Son	0	0	0	0	0	0	13	13
Fred T. Ley & Company	0	0	0	0	1	1	4	10
Leyte Land Transportation Co.	0	0	3	6	10	12	14	14
Lit Brothers	0	0	0	0	0	0	17	26
Los Angeles Brewing Company	0	0	2	7	13	14	15	17
Los Angeles Ice & Cold Stor. Co.	0	0	0	0	0	0	5	10
Henry C. Lytton & Sons (The Hub)	0	6	7	9	10	11	11	12
McCreery & Company	6	6	8	8	8	11	15	15
C. M. McKelvey Company	0	0	1	1	6	8	18	18
R. H. Macy & Company	0	0	0	0	0	0	15	15
Mandel Brothers	0	9	10	15	16	17	17	17
A. C. Marshall Company	0	0	0	0	0	0	0	15
State of Massachusetts	0	1	4	4	4	5	11	11
The May Company	0	0	0	4	11	15	26	26
Mesaba Transportation Company	0	0	0	0	0	2	15	18
Miami Valley Fruit Co.	0	0	0	0	0	0	0	12
Michelin Tire Company	0	1	2	3	3	9	11	11
National Casket Company	0	0	2	10	14	15	19	21
Province of New Brunswick	0	0	0	0	0	0	20	20
State of New York	0	0	3	3	3	5	29	37
City of New York	0	1	7	11	12	13	13	13
N. Y. Board of Fire Underwriters	0	0	2	6	8	16	20	20
Omaha Taxicab Company	0	0	0	0	6	8	17	17
Onondaga County, N. Y.	0	0	0	0	1	3	5	10
Oppenheim, Collins & Company	0	0	0	0	20	21	27	27
Pacific Mills	0	0	3	4	4	7	12	14
Frank Parmelee Company	0	0	0	9	9	18	28	28
Peninsula Rapid Transit Co.	0	0	0	0	0	7	8	15
State of Pennsylvania	0	0	0	0	1	2	5	15
Philadelphia Electric Company	0	0	0	0	0	0	13	15
City of Pittsburgh	0	2	9	14	14	15	15	15
Prest-o-lite Company	1	1	1	1	2	4	11	13
Pullman Taxicab Company	0	0	0	0	10	10	31	31
Quaker City Cab Company	0	0	0	0	0	0	75	100
Edward E. Rieck Company	0	0	0	0	0	0	2	16
Riverside Oil Company	0	0	0	0	0	0	0	16
Riverside Taxi Service Company	0	0	0	0	5	15	15	15
Rocky Mountain Motors Co.	0	0	2	2	3	3	21	23
The Rosenbaum Company	1	1	2	11	12	33	39	43
City of St. Louis	0	0	0	0	4	6	9	10
Saks & Company	0	0	0	0	10	10	10	10
San Bernardino Mount'n Auto Line	0	1	3	4	6	6	9	14
San Francisco Drayage Company	0	0	0	0	1	3	11	12
San Francisco Municipal Ry.	0	0	0	0	0	0	0	10
Schmidt & Ziegler, Ltd.	0	0	0	0	0	0	0	11
Schulze Baking Company	1	1	9	15	17	22	23	26
Seiple & Wolf	0	0	0	1	2	2	10	10
Franklin Simon & Company	0	0	0	3	6	10	14	14
W. & J. Sloane	13	14	15	15	15	17	21	23
Southern Express Company	0	0	0	2	9	11	31	41
Spear & Company	0	0	1	9	13	14	15	22
Standard Oil Co. of California	1	3	4	6	7	26	67	97
Standard Oil Co. of Indiana	1	4	5	9	59	122	168	201
Standard Oil Co. of Kentucky	0	1	2	4	5	9	38	75
Standard Oil Co. of Nebraska	0	0	0	0	5	11	17	17
Standard Oil Co. of New Jersey	0	0	1	1	1	1	3	30
Standard Oil Co. of New York	2	6	18	35	68	113	230	363
Standard Oil Co. of Ohio	0	1	1	1	10	17	28	36
Stark-Tuscarawas Brewing Co.	0	0	0	1	1	2	7	12
Sterling & Welch Company	2	4	7	7	8	8	11	14
Stern Brothers	0	0	8	18	18	19	21	22
Stewart Taxi Service Company	0	0	0	0	0	0	18	30
Strawbridge & Clothier	0	0	0	2	4	4	9	15
Stroehman Baking Company	0	0	0	2	2	2	10	10
Swift & Company	0	0	0	2	2	10	101	109
Taxicab Association, Inc.	0	0	0	26	40	76	151	151
Taxicab Company of California	0	0	19	39	59	59	59	69
Telling-Belle Vernon Company	0	3	4	4	9	11	11	13
E. B. Tenny	0	0	0	1	3	6	12	12
Terminal Taxicab Company	0	0	20	36	61	61	61	82
Arthur Tufts	0	0	0	0	0	0	0	15
Union Oil Company of California	0	0	0	1	10	22	43	156
Union Transfer Company	0	0	0	0	0	0	1	11
United Gas Improvement Co.	0	0	0	0	2	3	25	25
United Gas Imp't Co. Interests	0	0	0	2	6	12	16	34
United States Baking Co.	0	0	0	0	1	2	2	11
U. S. Post Office Department	0	0	0	21	27	104	132	298
U. S. Steel Corporation Interests	0	0	1	1	2	3	5	12
F. G. Vogt & Sons, Inc.	0	0	0	1	2	3	5	12
Wall Street Taxicab Company	0	0	0	0	0	0	14	19
John Wanamaker	0	0	0	0	0	6	27	37
Ward Baking Company	0	0	0	0	0	12	53	76
Raphael Weill & Company	0	0	0	0	0	10	10	15
Westcott Express Company	0	0	0	0	0	0	0	36
Western Electric Company	0	0	2	4	5	5	9	15
Western Meat Company	0	0	0	0	0	0	2	11
R. H. White Company	0	0	0	0	0	1	4	14
J. G. White & Co., Inc., Interests	0	1	1	1	1	1	4	16
White Bus Line Company	0	0	0	0	0	0	5	14
White Taxicab Company	0	0	0	0	0	0	2	11
White Transit Company	0	1	1	2	6	9	19	29
State of Wisconsin	0	0	0	0	0	0	15	15
Woodward & Lothrop, Inc.	0	1	1	3	3	4	7	13
Yellowstone Park Transport. Co.	0	0	0	0	0	0	106	112
Zumstein Taxicab Company	0	0	0	2	2	6	10	20
	54	191	508	1021	1747	2594	5114	7343

THE WHITE COMPANY

CLEVELAND

Make this Chart your guide



Look for it on your dealer's wall

EVERY time you stop for oil you face a question which is vital to the life of your car.

What will the dealer pour into your oil reservoir? Will it be just "oil"—or will it be the correct lubricant for *your* engine?

The better type of dealer and garage man now realizes that something like 50% of all engine troubles are due to incorrect lubrication.

He realizes, too, that scientific lubrication is a problem for specialists. And since the dealer has neither time nor equipment for studying this intricate subject he draws on the experience of a recognized authority.

That is why the large Chart of Recommendations, issued by the Vacuum Oil Company, is now fastened to the walls of thousands of supply shops and garages.

When you ask one of these dealers for "oil," he notes the make of your car—and the year's model. He runs his finger down the Chart (shown above in miniature) until he finds your car's make and model. Then he supplies you with the grade of Gargoyle Mobiloils specified for your car by the Chart. This oil will effectually seal your piston rings against power-waste, gasoline-waste and oil-waste.

* * *

THE Vacuum Oil Company for 50 years have specialized in scientific lubrication. Today their world-wide leadership in lubrication matters is unquestioned in scientific circles. For years their Chart of Recommendations has been recognized as the scientific guide to correct automobile lubrication.

In keeping this Chart up to date, each new model of every automobile is carefully analyzed. This work involves lengthy and painstaking engineering study by the Vacuum Oil Company's Board of Engineers. The recommendations of this Chart are proven correct by repeated practical tests.

But nothing has given dealers such faith in this Chart as their experience with the oils themselves. For no one knows better than the dealer how difficult it is to secure efficient lubrication and how much efficient lubrication means.

Write for 64-page booklet containing complete discussion of your lubrication problems, list of troubles with remedies and complete Charts of Recommendations for Automobiles, Motorcycles, Tractors and Motor-boat Engines.

GARGOYLE

Mobiloils

A grade for each type of motor

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. If the dealer has not the grade specified for your car, he can easily secure it for you.

VACUUM OIL COMPANY, New York, N. Y., U. S. A.

Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world

Domestic Branches: Detroit, Boston, Kansas City, Kan., New York, Chicago, Philadelphia, Indianapolis, Minneapolis, Pittsburgh, Des Moines

Correct Automobile Lubrication

Explanation: The four grades of Gargoyle Mobiloils, for engine lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

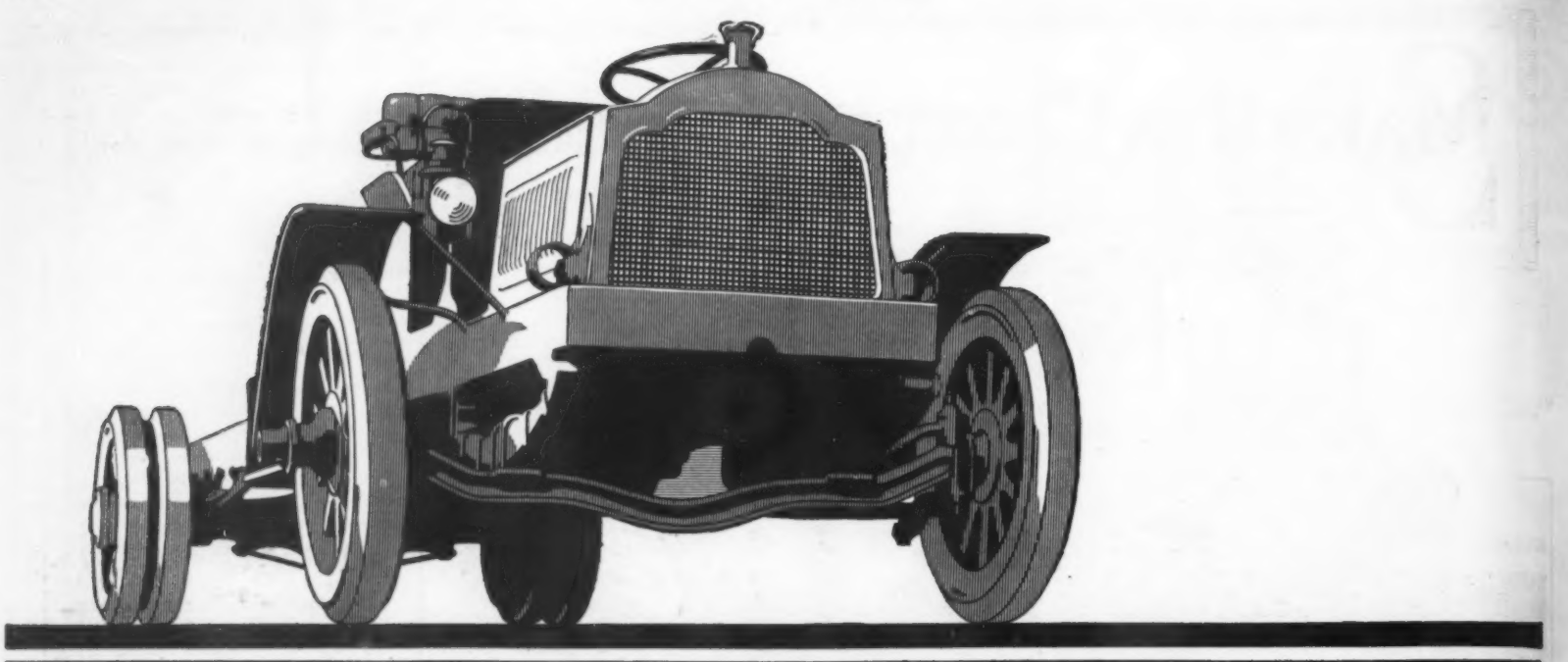
In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A," "Arc" means Gargoyle Mobiloil "Arctic," etc. The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

This Chart is compiled by the Vacuum Oil Company's Board of Engineers and represents our professional advice on Correct Automobile Lubrication.

AUTOMOBILES	1918		1917		1916		1915		1914	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Abbott	Arc	Arc								
Abbott-Detroit			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)					A	A	A	A		
Alco	A	Arc	A	Arc	A	Arc	A	Arc	A	A
Apperson	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Auburn (4 cyl)					A	Arc	A	Arc	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (6-38 & 6-39)			A	Arc	A	Arc				
" (6-39B) (Tractor H)	A	Arc								
" (6-39B) (Cont'l)	Arc	Arc								
Autocar (2 cyl)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Briscoe	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cyl)					A	A				
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
Cadillac	A	A	A	A	A	A	Arc	Arc	Arc	Arc
Case	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Chalmers	A	A			Arc	Arc	Arc	Arc	A	A
" (6-40)					A	Arc				
" (6-36)			A	A	A	A				
Chandler Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Chevrolet	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
" (8 cyl)	A	A	A	A						
" (F A)	A	Arc								
Cole					Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A	A	A		
Cunningham							Arc	Arc	Arc	Arc
" " (8 cyl)	A	A	A	A	A	A				
Dart	A	Arc	A	Arc	A	Arc	Arc	Arc	A	A
" (Mod. C)			A	Arc	A	Arc	A	Arc	A	A
" (2 & 3½ ton)	A	A								
Detroiter			Arc	Arc	Arc	Arc	A	Arc	A	A
Dodge	A	Arc	A	Arc	A	Arc	E	E		
Dort	A	Arc	A	Arc	A	Arc	A	Arc		
Empire (4 cyl)	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc				
Federal	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Mod. S-X)	A	A	A	A						
" (Special)	Arc	Arc								
Fiat	B	A	B	A	B	A	B	A	B	A
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	A
Grant	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Hal-Twelve			A	A	A	A				
Haynes	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (12 cyl)	A	A	A	A	A	A				
Hollier (6 cyl)	A	Arc	A	Arc						
" (8 cyl)	A	A	A	A	A	A	A	A		
Hudson			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Super Six)	A	Arc	A	Arc	A	A				
Hupmobile	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Jackson			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Jordan	Arc	Arc	Arc	Arc						
Kelly Springfield	A	A	A	A	A	A	A	A	A	A
King							A	Arc	A	A
" (8 cyl)	A	A	A	A	A	A	Arc	Arc		
" (Cont'l)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Kissel Kar	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" " (Mod. 48)			A	A	A	A	A	A	A	A
" " (12 cyl)	A	A	A	A						
Lexington			Arc	Arc	Arc	Arc	Arc	Arc		
Liberty (Detroit)	Arc	Arc	Arc	Arc						
Lippard Stewart	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" " (Mod. M)			A	Arc	A	Arc				
" " (Mod. MH)			A	Arc						
Locomobile	A	E	E	E	E	E	E	E	E	E
McFarlan	A	Arc	A	Arc	A	A	A	Arc	A	A
Madison	A	Arc	A	Arc	A	Arc	A	Arc		
" (8 cyl)			A	A	A	A				
Marmon	A	A	A	A	A	A	A	Arc	A	Arc
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	A	A	A	A	A	A	Arc	A	Arc
" (22-70)							Arc	Arc		
Mitchell	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cyl)					A	A				
Moline-Knight	B	A	A	A	A	A	A	A	A	A
National	Arc	Arc	Arc	Arc	A	Arc	A	Arc	A	A
" (12 cyl)	A	A	A	A	A	A				
Oakland	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)					A	A				
Oldsmobile	A	A			Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Overland			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Owen Magnetic	A	Arc	A	Arc	A	Arc	A	Arc		
" " (Mod. M22)	Arc	Arc	Arc	Arc						
Packard							A	Arc	A	Arc
" (12 cyl)	A	A	A	A	A	A				
" (Com'l)	A	A	A	A	A	A	A	A	Arc	Arc
Paige (4 cyl)							A	Arc	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
" (6-36)					A	Arc	A	Arc		
" (6-38-39)			A	Arc						
" (6-40)	A	Arc								
Paterson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Pathfinder			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (12 cyl)			A	A	A	A				
Peerless	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Pierce Arrow	A	A	A	A	A	A	Arc	Arc	Arc	Arc
" " (Com'l)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	Arc	A	Arc	A	Arc
Regal	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
(8 cyl)					A	Arc	Arc	Arc		
Renault (French)					A	Arc	A	Arc	A	Arc
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Riker	A	E	E	E						
Saxon	E	E	E	E	E	E	E	E	E	E
Selden			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (1½ ton)			A	Arc						
Singlex			A	A	A	A	Arc	Arc	Arc	Arc
Stearns-Knight	B	A	A	A	B	A	B	A	B	A
" (8 cyl)	B	A	A	A	B	A				
Studebaker	A	Arc	A	Arc	A	Arc	Arc	Arc	A	Arc
Stutz	A	A	A	A	A	A	A	A	A	A
Velie (4 cyl)							A	Arc	A	Arc
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (2 & 3½ ton)	Arc	Arc								
" (1½ ton)	A	Arc								
Westcott	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
White	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (16 valve)	A	A	A	A						
Willys-Knight	B	A	A	A	B	A	B	A	A	A
Willys Six			Arc	Arc						
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

Electric Vehicles: For motor bearings and enclosed chains use Gargoyle Mobiloil "A" the year 'round. For open chains and differential, use Gargoyle Mobiloil "C" the year 'round.

Exception: For *winter lubrication* of pleasure cars use Gargoyle Mobiloil "Arctic" for worm drive and Gargoyle Mobiloil "A" for bevel gear drive.



SECURE YOUR INVESTMENT

A MOTOR TRUCK is a sound investment only when it pays for itself and returns an ultimate profit to its owner. Its earning power is based on the service it renders over the period of its useful life.

The right truck is time-tested. It has ability to haul full loads year after year, keeping the ton-mile record high and the upkeep cost low.

Packard trucks are a known quantity. They offer you the quality you want, the service you must have, and the stability necessary to secure your investment.

Ask the man who owns one

PACKARD MOTOR CAR COMPANY

Detroit, Michigan